Earth Systems Pacific

REVISED SOILS ENGINEERING AND ENGINEERING GEOLOGY REPORT CANCER CENTER OF SANTA BARBARA NEW BUILDINGS 540 WEST PUEBLO STREET SANTA BARBARA, CALIFORNIA

May 14, 2009

Consulting Engineers and Geologists

EXHIBIT K

REVISED SOILS ENGINEERING AND ENGINEERING GEOLOGY REPORT CANCER CENTER OF SANTA BARBARA NEW BUILDINGS 540 WEST PUEBLO STREET SANTA BARBARA, CALIFORNIA

May 14, 2009

Prepared for

Cancer Center of Santa Barbara

Prepared by

Earth Systems Pacific
2049 North Preisker Lane, Suite E
Santa Maria, California 93454

Earth Systems Pacific

2049 Preisker Lane, Suite E
Santa Maria, CA 93454

(805) 928-2991
FAX (805) 928-9253

May 14, 2009 FILE NO.: SL-14435-SB

Mr. Brad Hess
Cancer Center of Santa Barbara
300 West Pueblo Street
Santa Barbara, CA 93105

PROJECT: CANCER CENTER OF SANTA BARBARA NEW BUILDINGS
540 WEST PUEBLO STREET, SANTA BARBARA, CALIFORNIA

SUBJECT: Revised Soils Engineering and Engineering Geology Report

Dear Mr. Hess:

In accordance with your authorization, this revised soils engineering and engineering geology report has been prepared for use in the development of plans and specifications for the new buildings planned at the Cancer Center of Santa Barbara, 540 West Pueblo Street in the City of Santa Barbara, California. This revised report is intended to replace the original soils engineering and engineering geology report in order to address a design change and to provide recommendations per the 2007 Edition of the California Building Code. Preliminary geotechnical recommendations for site preparation, grading, utility trenches, foundations, temporary backcut and shoring parameters, slabs-on-grade and exterior flatwork, retaining walls, pavement sections, drainage around improvements, and construction observation and testing are presented herein. This report also describes the general geologic characteristics and identifies existing and potential geologic hazards at the site, and discusses impacts that the geologic conditions may have upon the project. Four copies of this report are being furnished for your use.

We appreciate the opportunity to have provided services for this project and look forward to working with you again in the future. If there are any questions concerning this report, please do not hesitate to contact me.

Sincerely,

Earth Systems Pacific

Doug Dunham

Doug Dunham, G.E.

REGISTERED PROFESSIONAL ENGINEER
DOUGLAS A. DUNHAM
No. 2586
Exp. 12-31-09
GEOTECHNICAL
STATE OF CALIFORNIA

Richard T. Gorman, C.E.G.

PROFESSIONAL GEOLOGIST
RICHARD T. GORMAN
No. CEG 1325
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Doc. No. 0905-023.SER/ln

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1.0 INTRODUCTION

New buildings are planned for the Cancer Center of Santa Barbara (referred to herein as "the site") at 540 West Pueblo Street in the City of Santa Barbara, California. The site is shown on the Site Vicinity and Boring Location Maps in Appendix A.

We understand the project will generally consist of constructing four new buildings and a parking structure. The Cancer Center building will be three stories, will be of steel frame construction, and will utilize Portland cement concrete (PCC) slabs-on-grade. The remaining three support buildings will be one to two stories, will be of wood and steel frame construction, and will utilize PCC slabs-on-grade. The parking garage will be three stories, will be of reinforced PCC construction, and the first level will be constructed partially on grade and partially below grade. Retaining walls will be part of the subterranean areas of the parking garage structure. For the purposes of this report, maximum line loads of 6 kips per linear foot and maximum point loads of 200 kips were assumed.

Surface and subsurface improvements are also anticipated. We have assumed that access driveways for vehicles will be constructed with asphalt concrete (AC) and/or PCC pavement over aggregate base (AB), and that flatwork for pedestrian use will be constructed of PCC. Municipal sewer, water, storm drain, power, and communication utilities will provide service to the project. No on-site effluent disposal systems are planned at the site. Drainage basins will be used for to intercept runoff for site disposal; however, they are not within the scope of work for this report.

As the site is relatively level and near final grades, we have assumed that cuts and fills will be minimal to develop the building and surface improvement areas (defined in the "Preliminary Geotechnical Recommendations" section of this report), to improve access, and to improve drainage; no slopes will be constructed.

2.0 SCOPE OF SERVICES

The scope of work for the soils engineering and engineering geology report included a general site reconnaissance, subsurface exploration, laboratory testing of selected soil samples, geotechnical evaluation of the data collected, and preparation of this report. The report and subsequent preliminary geotechnical recommendations were based on information provided by the client.

The report and recommendations are intended to comply with the 2007 California Building Code (CBC), and common geotechnical practice in this area under similar conditions at this time. The test procedures were accomplished in general conformance with the standards noted, as modified by common geotechnical practice in this area under similar conditions at this time.

Preliminary geotechnical recommendations for site preparation, grading, utility trenches, foundations, temporary backcut and shoring parameters, slabs-on-grade and exterior flatwork, pavement sections, retaining walls, drainage around improvements, and construction observation and testing are presented to guide the development of project plans and specifications. It is our intent that this report be used exclusively by the client in the preparation of plans and specifications. Application beyond this intent is strictly at the user's risk. If other parties wish to use this report, such use will be allowed to the extent the report is applicable, only if the user agrees to be bound by the same contractual conditions as the original client, or contractual conditions that may be applicable at the time of the report use.

This report does not address issues in the domain of the contractor such as, but not limited to, site safety, subsidence of the site due to compaction, loss of volume due to stripping of the site, shrinkage of fill soils during compaction, excavatability, construction means and methods, etc. Analyses of the soil for mold potential, radioisotopes, asbestos (either man made or naturally occurring), hydrocarbons, or other chemical properties are beyond the scope of this report. Evaluation of the site for suitability for on-site effluent disposal systems or drainage basins is beyond the scope of this report. Ancillary structures/improvements such as temporary access roads, fences, flag and light poles, signage, etc.; and nonstructural fills and slopes are also not within our scope and are not addressed.

As there may be unresolved geotechnical issues with respect to this project, this firm should be retained to provide consultation as the design progresses, to review project plans as they near completion, to assist in verifying that pertinent geotechnical issues have been addressed, and aid in conformance with the intent of this report. In the event that there are any changes in the nature, design, or location of improvements, or if any assumptions used in the preparation of this report prove to be incorrect, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report verified or modified in writing. The criteria presented in this report are considered preliminary until such time as any peer review or review by any jurisdiction has been completed, conditions are observed by the soils engineer in the field during construction, and the recommendations have been verified as appropriate or modified in writing.

3.0 SITE SETTING

The site is at 540 West Pueblo Street in the City of Santa Barbara, California. West Pueblo and West Junipero Streets provide access to the site. The surrounding area is generally residentially developed; however, a municipal park is across West Junipero Street. The site is relatively flat with drainage by sheet flow. The site has been previously developed; existing improvements include, but are not limited to one and two story buildings, PCC flatwork, AC pavement, masonry walls, landscaping, and underground/overhead service utilities.

4.0 FIELD INVESTIGATION AND LABORATORY ANALYSIS

On June 29, 2007, a total of three borings were drilled to depths ranging from approximately 14.5 and 23 feet below the existing ground surface. The borings were drilled with a CME 75 drill rig, equipped with an 8-inch diameter hollow stem auger and an automatic trip hammer for sampling. The approximate locations of the borings are shown on the Boring Location Map.

Soils encountered in the borings were logged and categorized in general accordance with the Unified Soil Classification System and ASTM D 2488-06. Logs of the borings can also be found in Appendix A. Soil samples were taken using a ring-lined barrel sampler (ASTM D 3550-01, with shoe similar to D 2937-04). Standard penetration tests were also conducted at selected depths in the borings (ASTM D 1586-99). Bulk soil samples were obtained from the auger cuttings.

Ring samples were tested for unit weight and moisture (ASTM D 2937-04), as modified for ring liners. Two bulk samples were tested for maximum density and optimum moisture content (ASTM D 1557-07). Direct shear tests (ASTM D 3080-04) were conducted on the two bulk samples after they were remolded to approximately 90 percent of maximum dry density. One consolidation test (ASTM D 2435-04) was performed on a ring sample. Two bulk samples were also sent to Schiff Associates of Claremont, California for corrosivity testing for use by the architect/engineer in determining appropriate corrosion mitigation measures. Results of the laboratory data are presented in Appendix B.

5.0 GENERAL SOIL PROFILE

The soil profile observed in the borings generally consisted of a 5 to 11 foot surface layer of silty sand in a moist condition with a loose to medium dense consistency. The silty sand had trace amounts of fine gravel. Below the silty sand was well graded gravel with sand. The rocks in the sand matrix ranged from coarse gravel to boulder in size. Due to the abundant rocks, practical drilling refusal eventually terminated all the borings. Groundwater was not observed in the borings within the depths explored. Please refer to the boring logs for a more complete description of the subsurface conditions.

6.0 GEOLOGY

Geologic Site Conditions

The site is located on a coastal terrace or piedmont on the southern side of the Santa Ynez Mountain Range. The coastal piedmont extends from the base of the Santa Ynez Mountain Range to the Santa Barbara Channel. The site is located within an alluvial plain on the coastal piedmont, with the southwestern part of the property adjacent to Mission Creek.

Based on our subsurface field exploration, a review of Dibblee's geologic map (1986), and our site reconnaissance, the subsurface stratigraphy at the site consists of alluvial deposits. The alluvium consists of predominately of silty sand and gravel.

Faulting

According to the Fault Activity Map of California (Jennings, 1994), the closest mapped active faults to the site are the Red Mountain fault and the Santa Ynez fault, located approximately 18 miles southeast and 10 miles northwest of the site, respectively. Other significant regional *active* faults within a 65-mile radius of the site which could affect the proposed development during its anticipated lifespan include the Oak Ridge, Ventura – Pitas Point, Santa Cruz Island, and the San Andreas faults (see the Historical Earthquake/Fault Map in Appendix C).

The closest mapped faults, not considering activity, are the southerly dipping, reverse Mesa – Rincon Creek Fault and the Mission Ridge – Arroyo Parida Fault, located approximately ½ mile south and 1 mile north, respectively, of the site.

Groundwater

Groundwater was not encountered within any of the borings which were drilled to a maximum depth of 23 feet below the existing ground surface. The City of Santa Barbara Water Resource Division, Public Works Department provides well locations and historical groundwater levels recorded for 1999 through 2005 on its website. Well 4N/27W-17J1 is located very near to the site, across West Junipero Street to the northwest in Oak Park (see the Site Vicinity Map).

The year of 1999 contained the highest reported groundwater levels, ranging from 30.60 feet below the ground surface (bgs) in April and 34.87 feet bgs in September. The website indicates that the groundwater data relates to deep producing zones and may not be necessarily indicative of shallow groundwater levels.

Slope Stability

The site is relatively flat with no significant slopes on or adjacent to the site.

7.0 SEISMICITY

Earthquake History

The historic seismicity in the site region was researched using EQSEARCH (Blake, 2000, updated 2007) and the Boore and others (1997) method of analysis for a stiff soil profile (S_D per CBC Table 16-J). EQSEARCH is a computer program that performs automated searches of a custom catalog of historical central California earthquakes. As the program searches the catalog, it computes and prints the epicentral distance from the selected site to each of the earthquakes within the specified search area. The epicentral distances should be considered estimated distances, particularly for earthquake data information that dates prior to 1932, before instruments were used to record earthquake data. The parameters used for the search consisted of earthquake Richter magnitudes ranging from 5.0 to 9.0 that occurred in a 65-mile radius from the site from 1800 to 2007.

Results of the search indicated that within the search parameters, 57 earthquakes have occurred (see Historical Earthquake/Fault Map). The highest peak horizontal ground acceleration (PGA) estimated to have occurred at the site from those historical earthquakes is a 0.23g from a 5.7 magnitude earthquake. This earthquake occurred in 1862 and was located approximately 5 miles west of the site.

The largest magnitude earthquake that the search revealed was a 7.9 magnitude earthquake. This earthquake was located approximately 60 miles north of the site and was known as the 1857 earthquake on the San Andreas fault. It produced an estimated PGA of 0.13g at the site. The closest earthquake to the site was magnitude 5.0 and is estimated to have produced a PGA of 0.22g. It occurred in 1806 approximately 2.5 miles southeast of the site.

Ground Shaking

The site is in a region of generally high seismicity and has the potential of experiencing strong ground shaking from earthquakes on regional and/or local causative faults.

To characterize the seismicity at the site, we used the Maximum Considered Earthquake (MCE) as required by the CBC. The MCE earthquake is defined as having a 2 percent chance of exceedance in 50 years with a return period of approximately 2475 years. To calculate the MCE, we used the United States Geologic Survey (USGS) website. Based on the borings, the site classification per CBC Table 1613.5.2 is D (Stiff Soil Profile). The Design Response Spectra is in Appendix C. From the Design Response Spectra and using

$S_{DS}/2.5$, the site specific PGA is estimated at 0.51g. The results of the USGS analysis are as follows.

SUMMARY OF SEISMIC PARAMETERS

2007 CBC Mapped Values For Site Class B		**Site Class D Adjusted Values**				**Design Values**	
Seismic Parameters	Values (g)	Site Coefficients	Values	Seismic Parameters	Values (g)	Seismic Parameters	Values (g)
S_S	1.931	F_a	1.000	S_{MS}	1.931	S_{DS}	1.287
S_1	0.746	F_v	1.500	S_{M1}	1.119	S_{D1}	0.746

8.0 CONCLUSIONS

Geology

It is our opinion that there are no significant local geologic conditions that would preclude development at the site as described in the "Introduction" section of this report.

Site Geology

The site is underlain by alluvial deposits.

Groundwater

Groundwater was not encountered within any of the borings which were drilled to a maximum depth of 23 feet below the existing ground surface. Based on information from the City of Santa Barbara Water Resource Division, Public Works Department website, we have assumed groundwater could underlie the site at a depth of approximately 35 feet.

Slope Stability

The site is relatively flat with no significant slopes on or adjacent to the site; therefore, there is no potential for landsliding to impact the site.

Seismicity

The site is located within the seismically active southern California area, and moderate to severe ground shaking can be expected during the life of the proposed structures. The largest historical mean peak horizontal acceleration estimated to have occurred in the near vicinity of the site within the last 200 years was 0.23g. The site specific PGA is 0.51g.

Surface Ground Rupture

The site is not in a State Earthquake Fault Zone, and there are no mapped faults crossing or adjacent to the site. Therefore, the potential for surface ground rupture to occur within the site is considered to be very low.

Liquefaction

Soil liquefaction is the loss of soil strength during a significant seismic event. It occurs primarily in saturated, loose, fine to medium-grained sands, and in very soft to medium stiff silts. Common types of liquefaction-related ground failure include dynamic settlement and lateral spreading. As the depth to groundwater could be approximately 35 feet below the ground surface, we have assumed there is a potential for liquefaction to occur at the site below this depth.

Seismically Induced Settlement

Seismically induced settlement of sufficient magnitude to cause structural damage is normally associated with poorly consolidated, predominantly sandy soils, or variable consolidation characteristics within the building areas. Due to the medium dense to dense consistency of the underlying alluvium the potential for seismically induced settlement is very low.

Soils Engineering

In our opinion, the site is suitable, from a soils engineering standpoint, for the planned development as described in the "Introduction" section of this report, provided the recommendations contained herein are implemented in the design and construction. The primary geotechnical concerns are the potential for differential settlement, the stability of the soil during grading, the presence of oversized rocks in the soil, the erodible nature of the soil, drainage for the subterranean parking garage area, and the potential for liquefaction. The upper site soils were judged to be generally nonexpansive, therefore no special measures with respect to expansive soils are anticipated. Assuming the site is prepared in accordance with the recommendations of the "Preliminary Geotechnical Recommendations" section of this report, conventional continuous and spread footings may be used to support the planned structures.

Differential Settlement

Differential settlement can occur when foundations and surface improvements span materials having variable consolidation characteristics, such as the soils on this site with variable in situ moistures and densities. Such a situation could stress and possibly damage foundations and surface improvements, often resulting in severe cracks and displacement. To reduce this potential, it is necessary for all foundations and surface improvements to bear in material that is as uniform as practicable. A program of overexcavation and scarification in some cases, as well as moisture conditioning, and compaction of the upper soils in the building and surface improvement areas in all cases is recommended to provide more uniform soil moisture and density, and to provide appropriate foundation support.

Stability of Soil During Grading

The site soils may be susceptible to temporary high soil moisture conditions, especially during or soon after the rainy season. Attempting to compact the soil in an overly moist condition may promote unstable conditions in the form of pumping, yielding, shearing, and/or rutting. Therefore, the contractor and construction schedule should allow adequate time during grading for aerating and drying the soil to near optimum moisture content prior to compaction.

Oversized Rocks

Gravel, cobbles, and boulders were observed in the borings. Oversized rocks will require attention and special handling during construction of the site. Generally, soil materials used as fill should be cleaned of all debris and any rocks, and irreducible material larger than 6 inches in diameter. No rocks larger than 3 inches in diameter should be used within the upper 3 feet of finish grade. When fill material includes rocks, the rocks should be placed in a sufficient soil matrix to ensure that voids caused by nesting of the rocks will not occur and that the fill can be properly compacted. Rocks can also be problematic in excavations. Rocks can create oversized excavations and become a hazard for workers in the excavations. The contractor will need to be aware of these conditions to take appropriate action during construction.

Soil Erosion

The surface soils are highly erodible. Stabilization of surface soils, particularly those disturbed during construction, by vegetation or other means *during* and *following* construction is essential to reduce the potential of erosion damage. Care should be taken to establish and maintain proper drainage around the structures and improvements.

Drainage for the Subterranean Parking Garage Area

The subterranean portions of the parking garage area will need a drainage system to intercept the water from around the retaining walls and possibly below the PCC slab to transmit the water into the site drainage system. If it is not possible to outlet water into the site storm drain system by gravity flow, a sump pump will be necessary. Recommendations for the subslab drainage system are presented in the "Grading" section of this report.

Liquefaction

Soil liquefaction is the loss of soil strength during a significant seismic event. It occurs primarily in saturated, loose, fine to medium-grained sands, and in very soft to medium stiff, silts. As the depth to groundwater could be approximately 35 feet below the ground surface, we have assumed there is a potential for liquefaction to occur at the site below this depth. If liquefaction were to occur at the site, the repercussions would likely be in the form of dynamic settlement. As the thickness of the overlying non liquefiable soil layer is estimated to be much greater than the thickness of the potentially liquefiable soil layer(s), it is our opinion the potential for surface manifestation of any dynamic settlement is extremely low; however, all spread footings should be interconnected with grade beams so the foundation acts as an integral unit.

9.0 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

The following recommendations are applicable to the structures and improvements as described in the "Introduction" section of this report. If additional stories, subterranean areas deeper than 10 feet, or other such features are incorporated into site development, this firm should be contacted for individual assessment.

The building area is defined as the area within and extending a minimum of 5 feet beyond the foundation perimeter of the structure. The building area includes the foundation areas (plus 5 feet to each side) of any ancillary structure that will be rigidly attached to the main structure and is expected to perform in the same manner as the main structure. Such structures could include walls, staircases, covered walkways, covered patios, arbors, etc.

The surface improvement area is generally defined as the area within and extending a minimum of 1 foot beyond the perimeter of the exterior flatwork and pavement.

Site Preparation

1. The existing ground surface in the building and surface improvement areas should be prepared for construction by removing existing structures, improvements, vegetation, large roots, debris, and other deleterious material. Any existing fill soils should be completely removed and replaced as compacted fill. Any existing utilities that will not be serving the site should be removed or properly abandoned. The appropriate method of utility abandonment will depend upon the type and depth of the utility. Recommendations for abandonment can be made as necessary.

2. Voids created by the removal of materials or utilities, and extending below the recommended overexcavation depth, should be immediately called to the attention of the soils engineer. No fill should be placed unless a representative of this firm has observed the underlying soil.

Grading

1. Following site preparation, the soil in the building area of the three story structures should be removed on a level plane to a depth of 6 feet below the bottom of the deepest foundation element or 7 feet below existing grade, whichever is deeper. Locally deeper removals may be recommended, based on field conditions. The exposed surface should then be scarified to a minimum depth of 1 foot, moisture conditioned to near optimum moisture content, and compacted prior to the placement of fill soil.

2. Following site preparation, the soil in the building area of the three story structure elevator shafts should be removed on a level plane to a depth of 2 feet below the bottom of the deepest foundation element. Locally deeper removals may be recommended, based on field conditions. The exposed surface should then be scarified to a minimum depth of 1 foot, moisture conditioned to near optimum moisture content, and compacted prior to the placement of a minimum of 2 feet of Class 2 AB which is recommended under the elevator shafts.

3. Following site preparation, the soil in the building area of the one to two story structures should be removed on a level plane to a depth of 3 feet below the bottom of the deepest foundation element or 4 feet below existing grade, whichever is deeper. Locally deeper removals may be recommended, based on field conditions. The exposed surface should then be scarified to a minimum depth of 1 foot, moisture conditioned to near optimum moisture content, and compacted prior to the placement of fill soil.

4. The soil in the surface improvement area should be removed to a minimum depth of 1 foot below subgrade or 2 feet below existing grade, whichever is deeper. Locally deeper removals may be recommended, based on field conditions. The exposed soil surface should be scarified to a minimum depth of 1 foot, moisture conditioned to near optimum moisture content, and compacted prior to the placement of fill soil.

5. Voids created by dislodging cobbles, oversized rocks and/or debris during scarification should be backfilled and recompacted, and the dislodged materials should be removed from the work area.

6. On-site material and approved import materials may be used as general fill. Fill should be placed in level lifts, not exceeding 8 inches in loose thickness, moisture conditioned to near optimum moisture content, and compacted. In general, fill should be compacted to a minimum of 90 percent of maximum dry density. The upper 1-foot of subgrade and all AB in areas to be paved with AC or PCC should be compacted to a minimum of 95 percent of the maximum dry density. Subgrade and AB should be firm and unyielding when proofrolled with heavy, rubber-tired grading equipment prior to continuing construction.

7. A subslab blanket drain is recommended under the subterranean portion of the parking garage slabs where any portion of the slab vapor barrier will not be at least 1 inch above the exterior grade or, in the case of the slab abutting retaining walls and any portion of the vapor barrier will not be at least 1 inch above the invert of the retaining wall drains. The blanket drain should consist of a minimum 10-inch layer of free draining gravel. The surface beneath the gravel should be sloped a minimum of 2 percent to a series of low points. A drainpipe should be placed at each low point to collect and discharge the accumulated water into the site drainage system. A filter fabric conforming to Caltrans Standard Specification 88-1.03 for under drains should surround the blanket drain gravel. A vapor barrier and 2-inch sand cushion should be placed on top of the blanket drain filter fabric. The 2-inch sand cushion and the 10-inch gravel blanket drain are considered a substitute to the Class 2 AB (recommended for PCC flatwork that will support vehicle traffic in the "Slab-on-Grade and Exterior Flatwork" section of this report), not in addition to it. A subslab blanket drain detail is in Appendix D.

8. All imported soils should be nonexpansive. Nonexpansive soils are defined as being coarse grained (ASTM D 2488-06), and having an expansion index of 10 or less

(ASTM D 4829-07). Proposed nonexpansive imported soils should be evaluated by a representative of this firm before being used, and on an intermittent basis during placement on the site.

9. All materials used as fill should be cleaned of any debris and rocks larger than 6 inches in diameter. No rocks larger than 3 inches in diameter should be used within the upper 3 feet of finish grade. When fill material includes rocks, the rocks should be placed in a sufficient soil matrix to ensure that voids caused by nesting of the rocks will not occur and that the fill can be properly compacted.

Utility Trenches

1. Unless otherwise recommended, utility trenches adjacent to foundations should not be excavated within the zone of foundation influence, as shown on Typical Detail A in Appendix D.

2. Utilities that must pass beneath the foundation should be placed with properly compacted utility trench backfill and the foundation should be designed to span the trench.

3. A select, noncorrosive, granular, easily compacted material should be used as bedding and shading immediately around utilities. Generally, the soil found at the site may be used for trench backfill above the select. Soils with moisture levels above optimum moisture content may be difficult to compact to project standards.

4. In general, trench backfill should be compacted to a minimum of 90 percent of maximum dry density. A minimum of 95 percent of maximum dry density, however, should be obtained where trench backfill comprises the upper 1 foot of subgrade

beneath AC or PCC pavement, and in all AB. Subgrade and AB should be firm and unyielding when proof rolled with heavy, rubber-tired grading equipment prior to continuing construction. A minimum of 85 percent of maximum dry density will generally be sufficient where trench backfill is located in landscaped or other unimproved areas, where settlement of trench backfill would not be detrimental.

5. Jetting of trench backfill should generally not be allowed as a means of backfill densification. However, we do recommend that all import sand in multi-conduit trenches be jetted or saturated from the surface to aid in encasing the conduits with the import sand and to reduce the potential for hydro-collapse.

6. The recommendations of this section are minimum requirements and may be superseded by the requirements of the architect/engineer, the pipe manufacturer, the utility companies, or the governing jurisdiction.

Foundations

1. Conventional continuous and spread footings connected on at least two sides by grade beams bearing entirely in fill compacted may be used to support the planned structures. Grade beams should also be placed across all large entrances in the buildings. Footings and grade beams should have minimum overall dimensions in accordance with CBC 1805.4.2. All spread footings should be a minimum of 2 feet square.

2. Footing reinforcement should be in accordance with the requirements of the architect/engineer; minimum continuous footing and grade beam reinforcement should consist of two No. 4 rebar, one near the top and one near the bottom.

3. Conventional foundations should be designed using maximum allowable bearing capacities of 2,000 psf dead load and 3,000 psf dead plus live load. Using these criteria, maximum total and differential settlement are expected to be on the order of 3/4-inch and 3/8-inch in 25 feet, respectively.

4. Allowable bearing capacities may be increased by one-third when transient loads such as wind or seismicity are included. The foundations should be designed using the seismic parameters in the "Seismicity" section of this report.

5. Lateral loads may be resisted by friction and by passive resistance of the soil acting on foundations. Lateral capacity is based on the assumption that backfill adjacent to foundations is properly compacted. Please refer to the "Retaining Walls" section of this report for values.

6. Foundation excavations should be observed by this firm during excavation, and prior to placement of reinforcing steel or formwork. The foundation excavations should be moistened to at least optimum moisture content and no desiccation cracks should be present prior to concrete placement.

Temporary Backcut and Shoring Parameters

1. Construction backcuts and trenches should be excavated, sloped, and/or shored as per CALOSHA specifications. The soils are considered Type C soils per CALOSHA classification, and falling rocks should be anticipated.

2. Soil parameters for use in shoring design should be:

   Soil unit weight.. 125.0 pcf

   Angle of Internal Friction .... 35 degrees

Cohesion ....200 psf

K_a 0.27

K_p 3.69

3. Equivalent fluid pressures may be calculated by multiplying the coefficients K_a and K_p with a soil unit weight of 125.0 pcf.

4. External factors that may affect the shoring include foundation loads from the existing building, groundwater, adjacent underground conduits and utilities, surface and subsurface structures, loading and vibration from traffic and construction equipment, upslope conditions, and loads that may be applied by stockpiled construction materials and excavated soil. Such factors should be accommodated in the shoring or backcut design.

Slabs-on-Grade and Exterior Flatwork

1. Interior conventional foundation slabs-on-grade should have a minimum thickness of 4 full inches. Reinforcement size, placement, and dowels should be as directed by the architect/engineer; minimum slab reinforcement should consist of No. 3 rebar placed at 24 inches on-center each way. At a minimum, the slab should be doweled to footings and grade beams with No. 3 dowels lapped to the slab rebar at 24-inch spacing.

2. Due to the current use of impermeable floor coverings, water-soluble flooring adhesives, and the speed at which buildings are now constructed, moisture vapor transmission through slabs is a much more common problem than in past years. Where moisture vapor transmitted from the underlying soil would be undesirable, the slab should be protected from subsurface moisture vapor. A number of options for

vapor protection are discussed below; however, the means of vapor protection, including the type and thickness of the vapor barrier, if specified, are left to the discretion of the architect/engineer.

3. The most effective means of reducing the potential for infiltration of subsurface moisture vapor through the interior slabs would be to cast the slabs directly atop a durable, puncture and tear-resistant vapor barrier (e.g., polyolefin or HDPE conforming to ASTM E 1745-04, Class A or B). However, this option requires a special PCC mix with a very low water-cement ratio, as well as special finishing and curing procedures.

4. Probably the next most effective option would be vapor-inhibiting admixtures and/or surface sealers. This would also require special PCC mixes and placement procedures, depending upon the recommendations of the admixture or sealer manufacturer.

5. Another option that may be a reasonable compromise between effectiveness and cost considerations is the use of a subslab vapor barrier protected by a sand layer. If a durable, puncture and tear-resistant vapor barrier is specified (e.g., polyolefin or HDPE conforming to ASTM E 1745-04, Class A or B), the barrier can be placed directly on the nonexpansive soil layer. The barrier should be covered with a minimum 2 inches of *clean* sand. If a less durable vapor barrier is specified (i.e. ASTM E 1745-04, Class C), a minimum of 4 inches of clean sand should be provided on top of the nonexpansive soil, and the barrier should be placed in the center of the clean sand layer. Clean sand is defined as a well or poorly graded sand (ASTM D 2488-06) of which less than 3 percent passes the No. 200 sieve.

6. Where utilized, the vapor barrier should be placed a minimum of 1 inch above the flow line of the drainage path surrounding the structure, or 1 inch above the area drain grates if area drains are used to collect runoff around the structure. Care should be taken to properly lap and seal the barrier, particularly around utilities, and to protect it from damage during construction.

7. Saturation of any sand that lies above the vapor barrier should be avoided, as the excess moisture atop the vapor barrier could result in vapor transmission through the slab for a period of months or years.

8. Exterior flatwork should be reinforced, at a minimum, with No. 3 rebar at 24 inches on-center each way. If the flatwork will support vehicles, a modulus of subgrade reaction (K_{30}) of 100 psi/inch may be used in the design of slabs-on-grade founded on native soil. The modulus of subgrade reaction (K_{30}) may be increased to 300 psi/inch if the slab is underlain with a minimum of 12 inches of Class 2 AB material.

9. In conventional construction, it is common to use 4 to 6 inches of sand beneath exterior flatwork. Another measure that can be taken to reduce the risk of movement of flatwork due to variable bearing conditions, is to provide thickened edges or grade beams around the perimeters of the flatwork. The thickened edges or grade beams could be up to 12 inches deep, with the deeper edges or grade beams providing better protection. At a minimum, the thickened edge or grade beam should be reinforced by two No. 4 rebar, one at the top and one at the bottom.

10. Flatwork should be constructed with frequent joints to allow articulation as flatwork moves in response to expansion and contraction of the soil or variable bearing conditions. The soil in the subgrade should be moistened to at least optimum

moisture content and no desiccation cracks should be present prior to casting the flatwork.

11. Where maintaining the elevation of the flatwork at doorways and other areas is desired, the flatwork should be doweled to the perimeter foundation, at a minimum, by No. 3 dowels lapped to the flatwork rebar at 24-inch spacing. In other areas, the flatwork may be doweled to the foundation or the flatwork may be allowed to "float free," at the discretion of the architect/engineer. Flatwork that is intended to float free should be separated from foundations by a felt joint or other means.

12. To reduce shrinkage cracks in PCC, the PCC aggregates should be of appropriate size and proportion, the water/cement ratio should be low, the PCC should be properly placed and finished, contraction joints should be installed, and the PCC should be properly cured. PCC materials, placement, and curing specifications should be at the direction of the architect/engineer; AC 302.1R-04 is suggested as a resource for the architect/engineer in preparing such specifications.

Retaining Walls

1. Foundations for retaining walls should be designed in the same manner as those for the other structures (i.e., foundations in compacted fill). Foundations for retaining walls should have a minimum depth of 18 inches (not including the keyway) below the lowest adjacent grade. It is assumed that retaining walls will not exceed 12 feet in height.

2. Retaining wall design should be based on the following parameters:

Active equivalent fluid pressure (native soil)	40 pcf
Active equivalent fluid pressure (imported sand or gravel)	35 pcf
At rest equivalent fluid pressure (native soil or crushed rock)	60 pcf
At rest equivalent fluid pressure (imported sand or gravel)	50 pcf
Passive equivalent fluid pressure	400 pcf
Maximum toe pressure	3,000 psf
Coefficient of sliding friction	0.45

3. No surcharges are taken into consideration in the above values. The maximum toe pressure is an *allowable* value; no factors of safety, load factors or other factors have been applied to the remaining values. With the exception of the maximum toe pressure, these values may require application of appropriate factors of safety, load factors, and/or other factors as deemed appropriate by the architect/engineer.

4. The above pressures are applicable to a horizontal retained surface behind the wall. Walls having a retained surface that slopes upward from the wall should be designed for an additional equivalent fluid pressure of 1 pcf for the active case and 1.5 pcf for the at-rest case, for every two degrees of slope inclination.

5. If the values for sand or gravel backfill are utilized, the sand or gravel should be placed exclusively above a 1:1 plane extending from the base of the wall to 1 foot from daylight. The upper 1 foot should be backfilled with native soil except in areas where PCC or AC will abut the top of the wall. In these areas, the sand or gravel backfill should extend to the AB or to the slab sand cushion material.

6. All retaining walls should be drained with perforated pipe encased in a free draining gravel blanket. The pipe should be placed perforations downward and should

discharge in a nonerosive manner away from foundations and other improvements; or into the outlet system in the subterranean garage area. Cleanouts should be provided for the drains on maximum 50-foot centers. The gravel blanket should have a width of approximately 1 foot and should extend upward to approximately 1 foot from the top of the wall backfill. The upper foot should be backfilled with native soil, except in areas where the AC or PCC will abut the top of the wall. In such cases, the gravel should extend to the PCC sand cushion or the AB. To reduce infiltration of the soil into the gravel, a permeable synthetic fabric conforming to Caltrans Standard Specifications, Section 88-1.03 for under drains, should be placed between the two. Manufactured synthetic drains such as Miradrain or Enkadrain are acceptable alternatives to the use of gravel, provided that they are installed in accordance with the recommendations of the manufacturer. Where weep hole drainage can be properly discharged, the perforated pipe may be omitted in lieu of weep holes on maximum 4-foot centers. A filter fabric as described above should be placed between the weep holes and the drain gravel.

7. Walls facing habitable areas or areas where moisture transmission through the wall would be undesirable should be *thoroughly* waterproofed in accordance with the specifications of the architect/engineer.

8. The architect/engineer should bear in mind that retaining walls by their nature are flexible structures, and that surface treatments on walls often crack. Where walls are to be plastered or otherwise have a finish applied, the flexibility should be considered in determining the suitability of the surfacing material, spacing of horizontal and vertical control joints, etc. The flexibility should also be considered where a retaining wall will abut or be connected to a rigid structure, and where the geometry of the wall is such that its flexibility will vary along its length.

Pavement Sections

The following pavement sections are based on an assumed R-value of 40 and should be used for cost estimating purposes only. We recommend that the soil exposed at rough driveway/parking area subgrade be tested for R-value to verify that the assumed pavement sections are appropriate, otherwise revised pavement sections will be needed. Pavement design sections are provided for Traffic Indices (TI) of 4.5, 5.0, 5.5, 6.0, 6.5, and 7.0. Determination of the appropriate TI for specific areas is left to others. The structural sections were calculated in accordance with the Caltrans Highway Design Manual. The calculated AB and AC thickness are for compacted material. Normal Caltrans construction tolerances should apply.

R-value	TI	AC Thickness (inches)	Class 2 AB Thickness (inches)
40	4.5	2.50	4.0
40	5.0	2.75	4.5
40	5.5	3.00	5.5
40	6.0	3.25	6.0
40	6.5	3.75	6.5
40	7.0	4.00	7.0

1. The upper 12 inches of subgrade and all AB should be compacted to a minimum of 95 percent of maximum dry density.

2. Subgrade and AB should be firm and unyielding when proofrolled by heavy rubber-tired equipment prior to paving.

3. Finished AC surfaces should slope toward drainage facilities such that rapid runoff will occur and no ponding is allowed on or adjacent to the AC.

4. To reduce migration of surface drainage into the subgrade, maintenance of pavement areas is critical. Any cracks that develop in the pavement should be promptly sealed.

Drainage Around Improvements

The goal of finish grading, landscaping and finish improvements should be to maintain the soils near the foundations at as uniform a moisture content as practicable. This will entail providing proper surface drainage so that runoff flows freely away from foundations and does not stand or pond near improvements. Maintaining uniform moisture near foundations will also entail protecting soils from prolonged drying that would result in desiccation and soil shrinkage. If xeroscaping will be used around the structure or if the soils will be allowed to desiccate for any reason, the recommendations of this report may require modification.

1. Unpaved ground surfaces should be graded *during construction,* and *finish graded* to direct surface runoff away from foundations, retaining walls, and other improvements at a minimum 2 percent grade for a minimum distance of 5 feet. Where this is not practicable due to terrain, proximity to property lines, etc., swales with improved surfaces, area drains, etc., should be used to collect and discharge runoff.

2. To reduce the potential for planter drainage from gaining access to subslab areas, raised planter boxes adjacent to foundations should be installed with drains and sealed sides and bottoms. Drains should also be provided for areas adjacent to structures that would not otherwise freely drain.

3. The eaves of all structures should be fitted with roof gutters. Runoff from driveways, roof gutters, downspouts, planter drains, area drains, etc. should discharge in a nonerosive manner away from foundations and other improvements in accordance with the requirements of the governing agencies.

4. The on-site soils are highly erodible. Stabilization of surface soils, particularly those disturbed during construction, by vegetation or other means *during* and *following* construction is essential to reduce erosion damage. Care should be taken to establish and maintain vegetation. The landscaping should be planned and installed to maintain the surface drainage recommended above. Surface drainage should also be maintained during construction.

Construction Observation and Testing

1. It must be recognized that the recommendations contained in this report are based on a limited number of borings, and rely on continuity of the subsurface conditions encountered. It is assumed that this firm will be retained to provide consultation during the design phase, to review final plans once they are available, to interpret this report during construction, and to provide construction monitoring in the form of testing and observation.

2. Unless otherwise stated, the terms "compacted" and "recompacted" refer to soils placed in level lifts not exceeding 8 inches in loose thickness and compacted to a minimum of 90 percent of maximum dry density.

3. Unless otherwise stated, "moisture conditioning" refers to the moistening or drying of soils to at least optimum moisture content, prior to application of compactive effort.

4. The standard tests used to define maximum dry density and field density should be ASTM D 1557-07 and ASTM D 6938-07b, respectively, or other methods acceptable to the soils engineer and jurisdiction.

5. At a minimum, the soils engineer should be retained to provide:
   - Review of final grading, utility, and foundation plans
   - Professional observation during grading, foundation excavations, and trench backfill
   - Oversight of compaction testing during grading
   - Oversight of Special Inspection during grading

6. Compaction of native and fill soils, and backfill of excavations and trenches, should be considered to fall under Section 1704.7 "Soils" of the CBC. Special Inspection of grading/backfill should be provided as per Section 1704.7 and Table 1704.7 of the CBC. The Special Inspector should be under the direction of the soils engineer.

7. In our opinion, the following operations are considered to be work of a minor nature as it relates to specific inspections in Section 1704 of the CBC. Therefore, with the approval of the Building Official, grading observations and testing can be performed in lieu of the Special Inspection:
   - Stripping and clearing of vegetation
   - Overexcavation to the recommended depths
   - Scarification, moisture conditioning, and compaction of the soil
   - Fill quality, placement, and compaction
   - Utility trench backfill
   - Retaining wall drains and backfill
   - Foundation excavations

- Subgrade and AB compaction and proof rolling

8. A program of quality control should be developed prior to beginning grading. The contractor or project manager should determine any additional inspection items required by the architect/engineer or the governing jurisdiction.

9. In accordance with CBC Section 1803.5 the following locations and frequency of tests are recommended. At a minimum, the Special Inspector should verify that:
   - A minimum of one compaction test is taken in the subgrade at the bottom of the removal area, in each 1.0 feet of fill placed, and at final AB grade.
   - A minimum of one compaction test is taken in each site utility trench for every 1.5 feet above the pipe, for every 25 linear feet of trench, or fraction thereof.

   The soils engineer may elect to increase or decrease the testing frequency at the time of construction, depending on the actual soil conditions exposed, the compaction equipment being utilized, the initial test results, or other factors.

10. A preconstruction conference between the owner, the soils engineer, the Special Inspector, the architect/engineer, and contractors is recommended to discuss planned construction procedures and quality control requirements. The above recommendations relative to continuous and periodic Special Inspection, and test location and frequency may be subject to modification by the soils engineer, based upon soil and moisture conditions encountered, size and type of equipment used by the contractor, the general trend of the results of compaction tests, or other factors.

11. The soils engineer should be notified at least 48 hours prior to beginning construction operations. If Earth Systems Pacific is not retained to provide construction observation and testing services, it shall not be responsible for the interpretation of the information by others or any consequences arising therefrom.

10.0 CLOSURE

This report is valid for conditions as they exist at this time for the type of development described herein. Our intent was to perform the investigation in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the locality of this project under similar conditions at this time. No representation, warranty, or guarantee is either expressed or implied. This report is intended for the exclusive use by the client as discussed in the "Scope of Services" section. Application beyond the stated intent is strictly at the user's risk.

If changes with respect to development type or location become necessary, if items not addressed in this report are incorporated into plans, or if any of the assumptions used in the preparation of this report are not correct, this firm shall be notified for modifications to this report. Any items not specifically addressed in this report shall comply with the CBC and the requirements of the governing jurisdiction.

The preliminary recommendations of this soils report are based upon the geotechnical conditions encountered at the site, and may be augmented by additional requirements of the architect/engineer, or by additional recommendations provided by this firm based on peer or jurisdiction reviews, or conditions exposed at the time of construction.

This document, the data, conclusions, and recommendations contained herein are the property of Earth Systems Pacific. This report shall be used in its entirety, with no individual sections reproduced or used out of context. Copies may be made only by Earth Systems Pacific, the client, and the client's authorized agents for use exclusively on the subject project. Any other use is subject to federal copyright laws and the written approval of Earth Systems Pacific.

Thank you for this opportunity to have been of service. If you have any questions, please feel free to contact this office at your convenience.

End of Text

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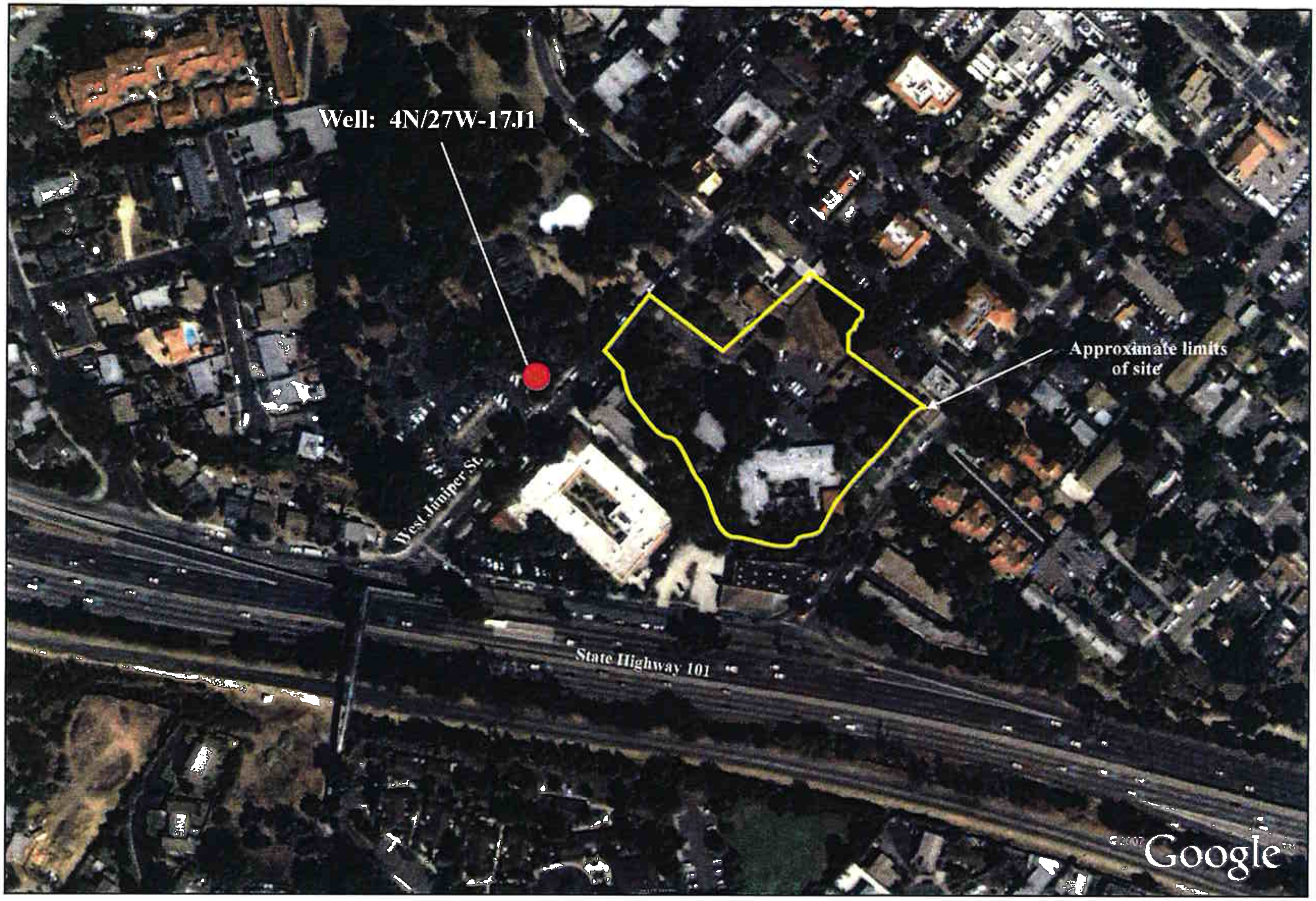
APPENDIX A

Site Vicinity Map

Boring Location Map

Boring Logs

SITE VICINITY MAP
CANCER CENTER OF SANTA BARBARA
540 West Pueblo Street
Santa Barbara, California



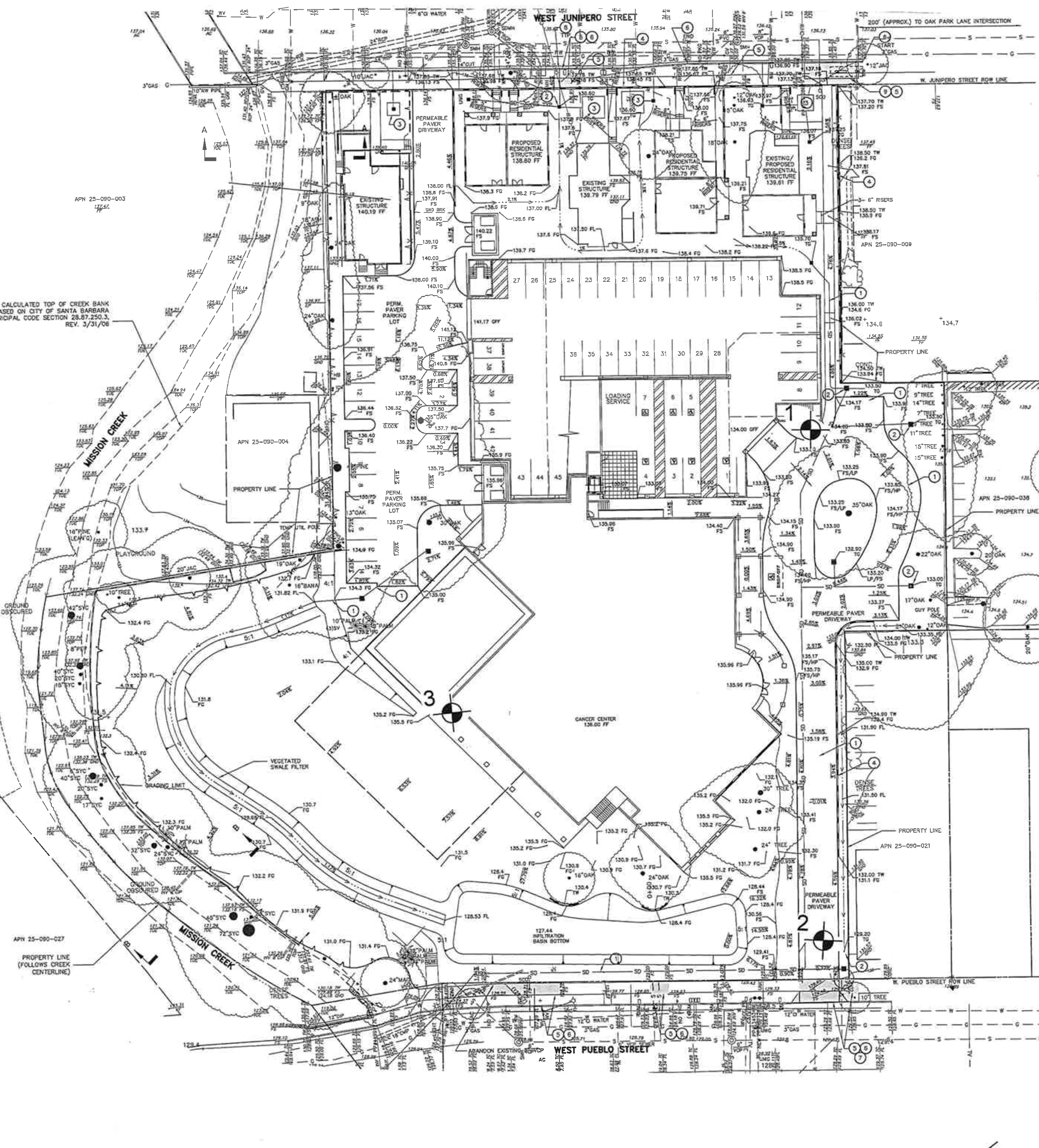
EARTH SYSTEMS PACIFIC
4378 Santa Fe Road, San Luis Obispo, CA 93401
July 2007

(805) 544-3276 - (805) 544-1786
www.earthsys.com - email: esc@earthsys.com
SL-14435-SA

BORING LOCATION MAP

CANCER CENTER OF SANTA BARBARA

540 West Pueblo Street
Santa Barbara, California



NOT TO SCALE

LEGEND

3 Boring Location (Approx.)

Earth Systems Pacific

May 14, 2009

2049 North Preisker Lane, Suite E
Santa Maria, California 93454
(805) 928-2991 • FAX (805) 928-9253
E-mail: esc@earthsys.com

SMK

SL-14435-SB

Cancer Center of Santa Barbara Revised BLM 051409.dwg

Earth Systems Pacific

BORING LOG LEGEND

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	MORE THAN HALF OF MATERIAL IS TESTED OR JUDGED TO BE LARGER THAN #200 SIEVE SIZE	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES
		GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES
		SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES
		SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES
FINE GRAINED SOILS	HALF OR MORE OF MATERIAL IS TESTED OR JUDGED TO BE SMALLER THAN #200 SIEVE SIZE	ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY, CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY, SILTY SOILS, ELASTIC SILTS
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
		PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

SAMPLE / SUBSURFACE WATER SYMBOLS

SAMPLE / SUBSURFACE WATER SYMBOLS
CALIFORNIA MODIFIED
STANDARD PENETRATION TEST (SPT)
SHELBY TUBE
BULK
SUBSURFACE WATER DURING DRILLING
SUBSURFACE WATER AFTER DRILLING

OBSERVED MOISTURE CONDITION

DRY	SLIGHTLY MOIST	MOIST	VERY MOIST	WET
LITTLE/NO MOISTURE	JUDGED BELOW OPTIMUM	JUDGED ABOUT OPTIMUM	JUDGED OVER OPTIMUM	SATURATED

TYPICAL CONSISTENCY

COARSE GRAINED SOILS

BLOWS/FOOT SPT	BLOWS/FOOT CA SAMPLER	DESCRIPTIVE TERM
0-10	0-16	LOOSE
11-30	17-50	MEDIUM DENSE
31-50	51-83	DENSE
OVER 50	OVER 83	VERY DENSE

FINE GRAINED SOILS

BLOWS/FOOT SPT	BLOWS/FOOT CA SAMPLER	DESCRIPTIVE TERM
0-2	0-3	VERY SOFT
3-4	4-7	SOFT
5-8	8-13	MEDIUM STIFF
9-15	14-25	STIFF
16-30	26-50	VERY STIFF
OVER 30	OVER 50	HARD

GRAIN SIZES

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENING		
# 200	# 40	# 10	# 4	3/4"	3"	12"

SILT & CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

TYPICAL ROCK HARDNESS

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
EXTREMELY HARD	CORE, FRAGMENT, OR EXPOSURE CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CAN ONLY BE CHIPPED WITH REPEATED HEAVY HAMMER BLOWS
VERY HARD	CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CORE OR FRAGMENT BREAKS WITH REPEATED HEAVY HAMMER BLOWS
HARD	CAN BE SCRATCHED WITH KNIFE OR SHARP PICK WITH DIFFICULTY (HEAVY PRESSURE); HEAVY HAMMER BLOW REQUIRED TO BREAK SPECIMEN
MODERATELY HARD	CAN BE GROOVED 1/16 INCH DEEP BY KNIFE OR SHARP PICK WITH MODERATE OR HEAVY PRESSURE; CORE OR FRAGMENT BREAKS WITH LIGHT HAMMER BLOW OR HEAVY MANUAL PRESSURE
SOFT	CAN BE GROOVED OR GOUGED EASILY BY KNIFE OR SHARP PICK WITH LIGHT PRESSURE, CAN BE SCRATCHED WITH FINGERNAIL; BREAKS WITH LIGHT TO MODERATE MANUAL PRESSURE
VERY SOFT	CAN BE READILY INDENTED, GROOVED OR GOUGED WITH FINGERNAIL, OR CARVED WITH KNIFE; BREAKS WITH LIGHT MANUAL PRESSURE

TYPICAL ROCK WEATHERING

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
FRESH	NO DISCOLORATION, NOT OXIDIZED
SLIGHTLY WEATHERED	DISCOLORATION OR OXIDATION IS LIMITED TO SURFACE OF, OR SHORT DISTANCE FROM; SOME FRACTURES PRESENT; FELDSPAR CRYSTALS ARE DULL
MODERATELY WEATHERED	DISCOLORATION OR OXIDATION EXTENDS FROM FRACTURES, USUALLY THROUGHOUT; Fe-Mg MINERALS ARE "RUSTY"; FELDSPAR CRYSTALS ARE "CLOUDY"
INTENSELY WEATHERED	DISCOLORATION OR OXIDATION THROUGHOUT; FELDSPAR AND Fe-Mg MINERALS ARE ALTERED TO CLAY TO SOME EXTENT OR CHEMICAL ALTERATION PRODUCES IN SITU DISAGGREGATION
DECOMPOSED	DISCOLORATION OR OXIDATION THROUGHOUT, BUT RESISTANT MINERALS SUCH AS QUARTZ MAY BE UNALTERED; FELDSPAR AND Fe-Mg MINERALS ARE COMPLETELY ALTERED TO CLAY

drafting/masters/Boring Log Legend091608.dwg

Earth Systems Pacific

Boring No. 1

LOGGED BY: B. Fagundes
DRILL RIG: CME 75
AUGER TYPE: 8" Hollow Stem

PAGE 1 OF 1
JOB NO.: SL-14435-SB
DATE: June 29, 2007

CANCER CENTER OF SANTA BARBARA
540 West Pueblo Street
Santa Barbara, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0–5	SM		Alluvium (Qa): SILTY SAND; dark brown, loose, moist, trace fine gravel	0–5	Grab Sample			
				4.5–6.0	Ring Sample	114.5	4.3	10 50/4"
5–23	GW		WELL GRADED GRAVEL WITH SAND; brown, dense, moist, coarse gravel to boulder size rocks	6–10	Grab Sample			
				9.5–110	Ring Sample	117.1	3.6	29 50/6"
				14.5–16.0	Ring Sample	103.5	3.6	50/5"
				19.5–21.0	Ring Sample	111.9	3.4	40 50/1"
23			End of boring @ 23.0 feet No subsurface water encountered Auger refusal @ 23.0 feet					

LEGEND: ■ Ring Sample ○ Grab Sample □ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 2

LOGGED BY: B. Fagundes
DRILL RIG: CME 75
AUGER TYPE: 8" Hollow Stem

PAGE 1 OF 1
JOB NO.: SL-14435-SB
DATE: June 29, 2007

CANCER CENTER OF SANTA BARBARA
540 West Pueblo Street
Santa Barbara, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM	Alluvium (Qa): SILTY SAND; dark brown, loose, moist, trace fine gravel					
4			4.0–5.5	Ring Sample	104.9	7.8	3 5 7
7		brown, medium dense, damp					
9			9.0–10.5	Ring Sample	115.8	6.2	10 16 20
11	GW	WELL GRADED GRAVEL WITH SAND; brown, dense, moist, coarse gravel to boulder size rocks					
13			13.0–14.5	Ring Sample	106.5	6.4	50/2"
14.5		End of boring @ 14.5 feet No subsurface water encountered					

LEGEND: ■ Ring Sample ○ Grab Sample □ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

LOGGED BY: B. Fagundes
DRILL RIG: CME 75
AUGER TYPE: 8" Hollow Stem

Boring No. 3

JOB NO.: SL-14435-SB
DATE: June 29, 2007

CANCER CENTER OF SANTA BARBARA
540 West Pueblo Street
Santa Barbara, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0		4" Asphaltic Concrete over Aggregate Base					
0.5	SM	Alluvium (Qa): SILTY SAND; dark brown, loose, moist, trace fine gravel					
4.5		brown, medium dense	4.5–6.0	■	106.5	6.4	5 10 12
9	GW	WELL GRADED GRAVEL WITH SAND; brown, dense, moist, coarse gravel to boulder size rocks	9.5–11.0	■	116.9	3.5	28 48 50/4"
14			14.0–15.5	■	105.5	2.1	50/5"
19		End of boring @ 19.0 feet No subsurface water encountered Auger refusal @ 19.0 feet					

LEGEND: ■ Ring Sample ○ Grab Sample □ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

APPENDIX B

Laboratory Test Results

Cancer Center of Santa Barbara SL-14435-SB

BULK DENSITY TEST RESULTS

ASTM D 2937-04 (modified for ring liners)

July 19, 2007

BORING NO.	DEPTH feet	MOISTURE CONTENT, %	WET DENSITY, pcf	DRY DENSITY, pcf
1	5.5 - 6.0	4.3	119.5	114.5
1	10.0 - 10.5	3.6	121.3	117.1
1	14.5 - 15.0	3.6	107.2	103.5
1	20.0 - 20.5	3.4	115.7	111.9
2	5.0 - 5.5	7.8	112.6	104.5
2	10.0 - 10.5	6.2	122.9	115.8
3	5.5 - 6.0	6.4	113.3	106.5
3	10.5 - 11.0	3.5	121.0	116.9
3	14.5 - 15.0	2.1	107.7	105.5

Cancer Center of Santa Barbara SL-14435-SB

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-02

PROCEDURE USED: A

July 19, 2007

PREPARATION METHOD: Moist

Boring #1 @ 0.0 - 5.0'

RAMMER TYPE: Mechanical

Silty Sand (SM)

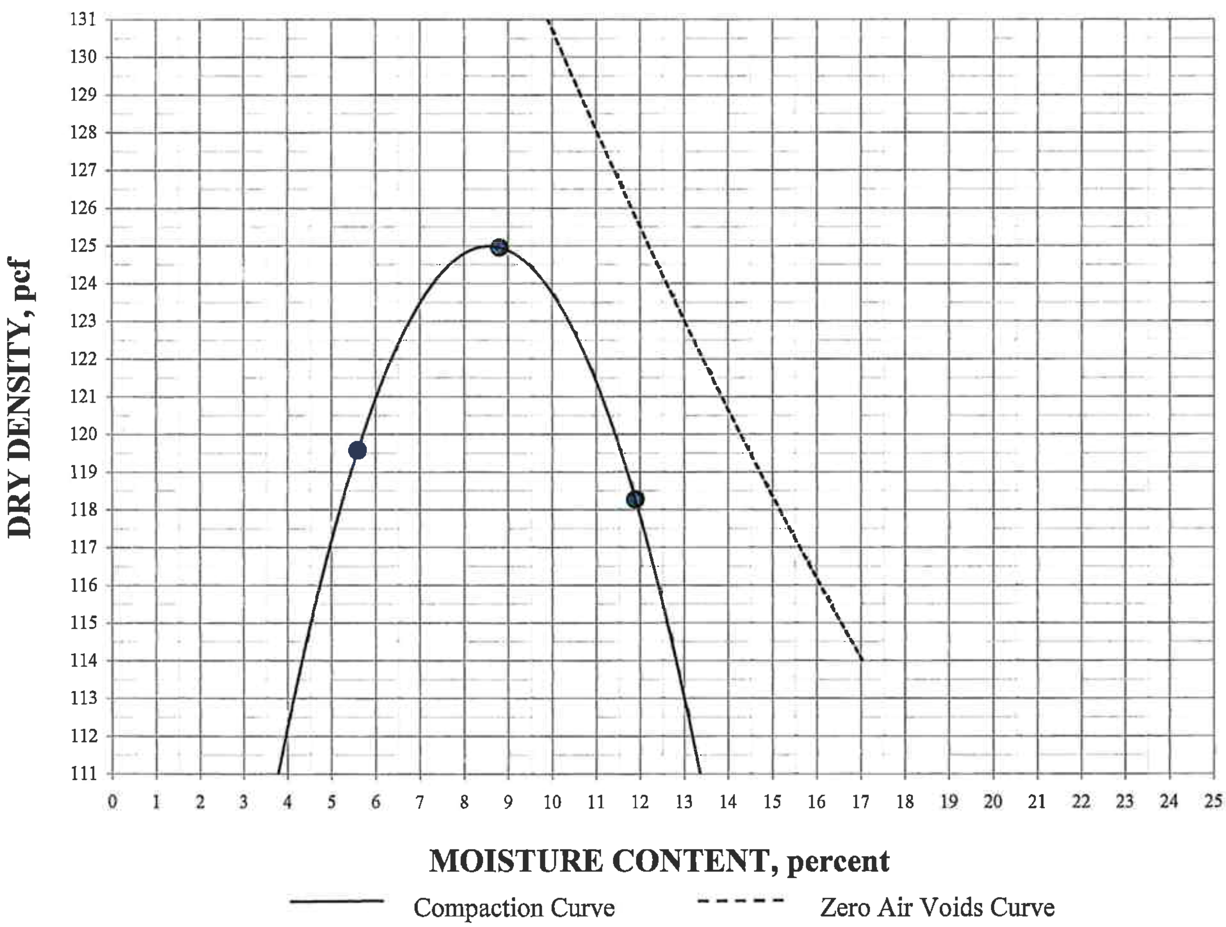
SPECIFIC GRAVITY: 2.65 (assumed)

SIEVE DATA:

Sieve Size	% Retained
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 125.0 pcf

OPTIMUM MOISTURE: 8.5%



Cancer Center of Santa Barbara

SL-14435-SB

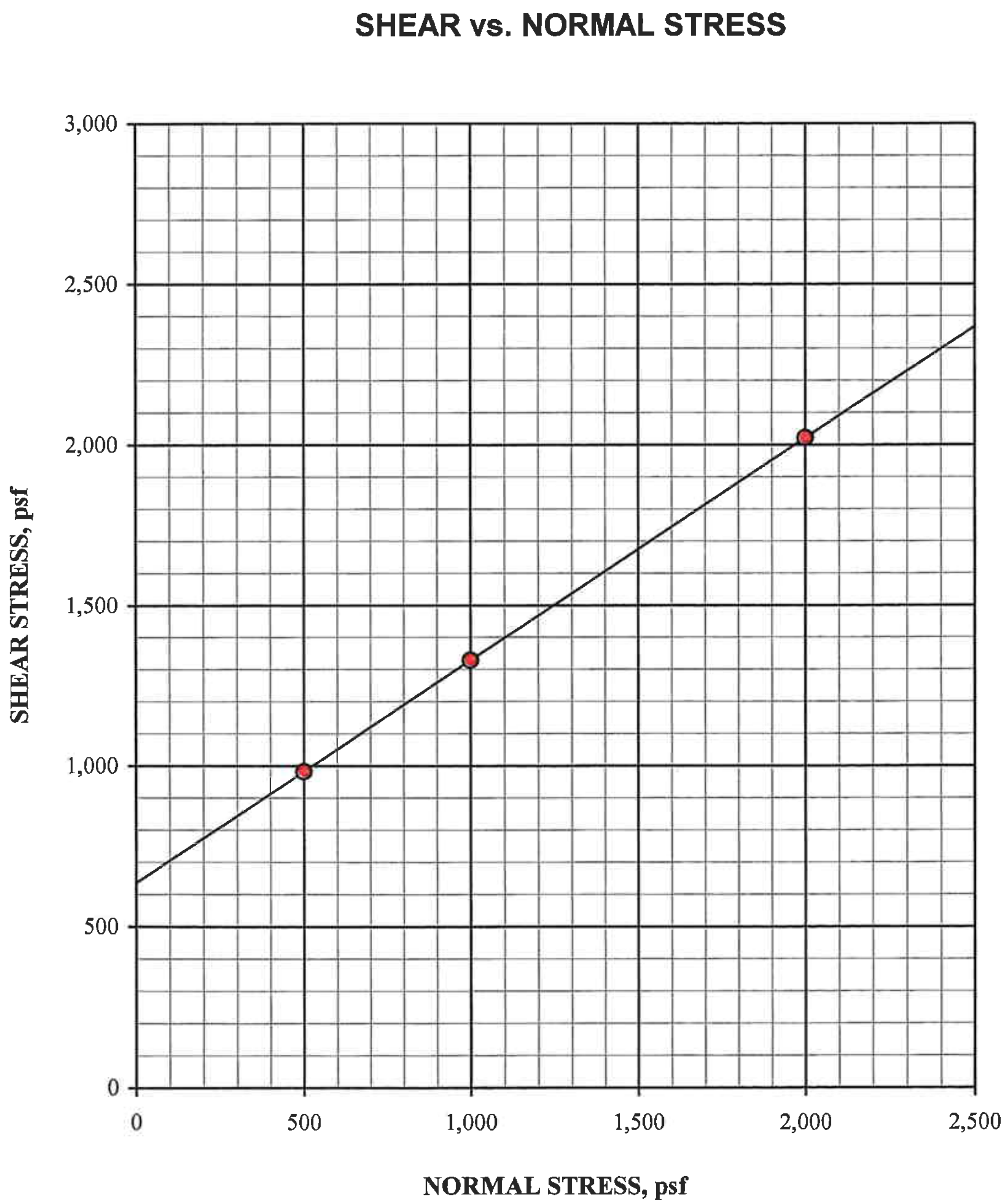
DIRECT SHEAR

ASTM D 3080-04 (modified for consolidated, undrained conditions)

July 19, 2007

Boring #1 @ 0.0 - 5.0'
Silty Sand (SM)
Compacted to 90% RC, saturated

INITIAL DRY DENSITY: 112.5 pcf
INITIAL MOISTURE CONTENT: 9.0 %
PEAK SHEAR ANGLE (Ø): 35°
COHESION (C): 637 psf



Cancer Center of Santa Barbara SL-14435-SB

DIRECT SHEAR continued

ASTM D 3080-04 (modified for consolidated, undrained conditions)

Boring #1 @ 0.0 - 5.0'

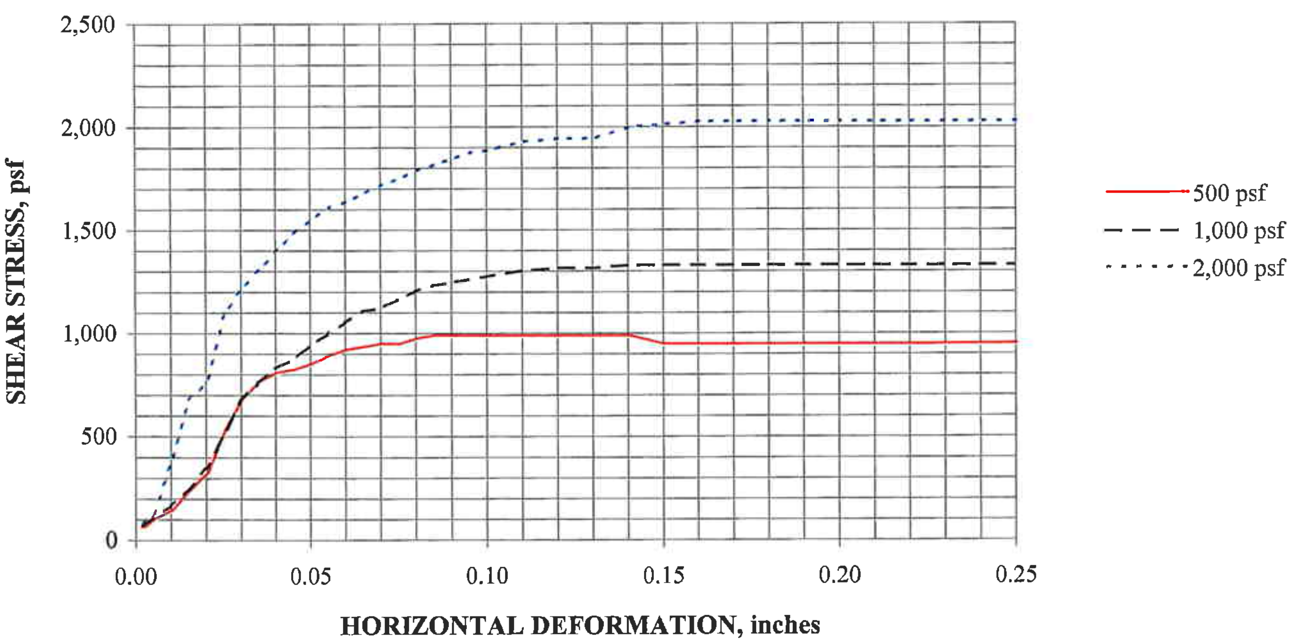
July 19, 2007

Silty Sand (SM)

Compacted to 90% RC, saturated

SPECIFIC GRAVITY: 2.65 (assumed)

SAMPLE NO.:	1	2	3	AVERAGE
INITIAL				
WATER CONTENT, %	9.0	9.0	9.0	9.0
DRY DENSITY, pcf	112.5	112.5	112.5	112.5
SATURATION, %	50.8	50.8	50.8	50.8
VOID RATIO	0.470	0.470	0.470	0.470
DIAMETER, inches	2.375	2.375	2.375	
HEIGHT, inches	1.00	1.00	1.00	
AT TEST				
WATER CONTENT, %	15.3	15.2	15.3	
DRY DENSITY, pcf	117.8	118.9	119.3	
SATURATION, %	100.0	100.0	100.0	
VOID RATIO	0.404	0.390	0.386	
HEIGHT, inches	0.96	0.95	0.94	



Cancer Center of Santa Barbara | SL-14435-SB

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-02

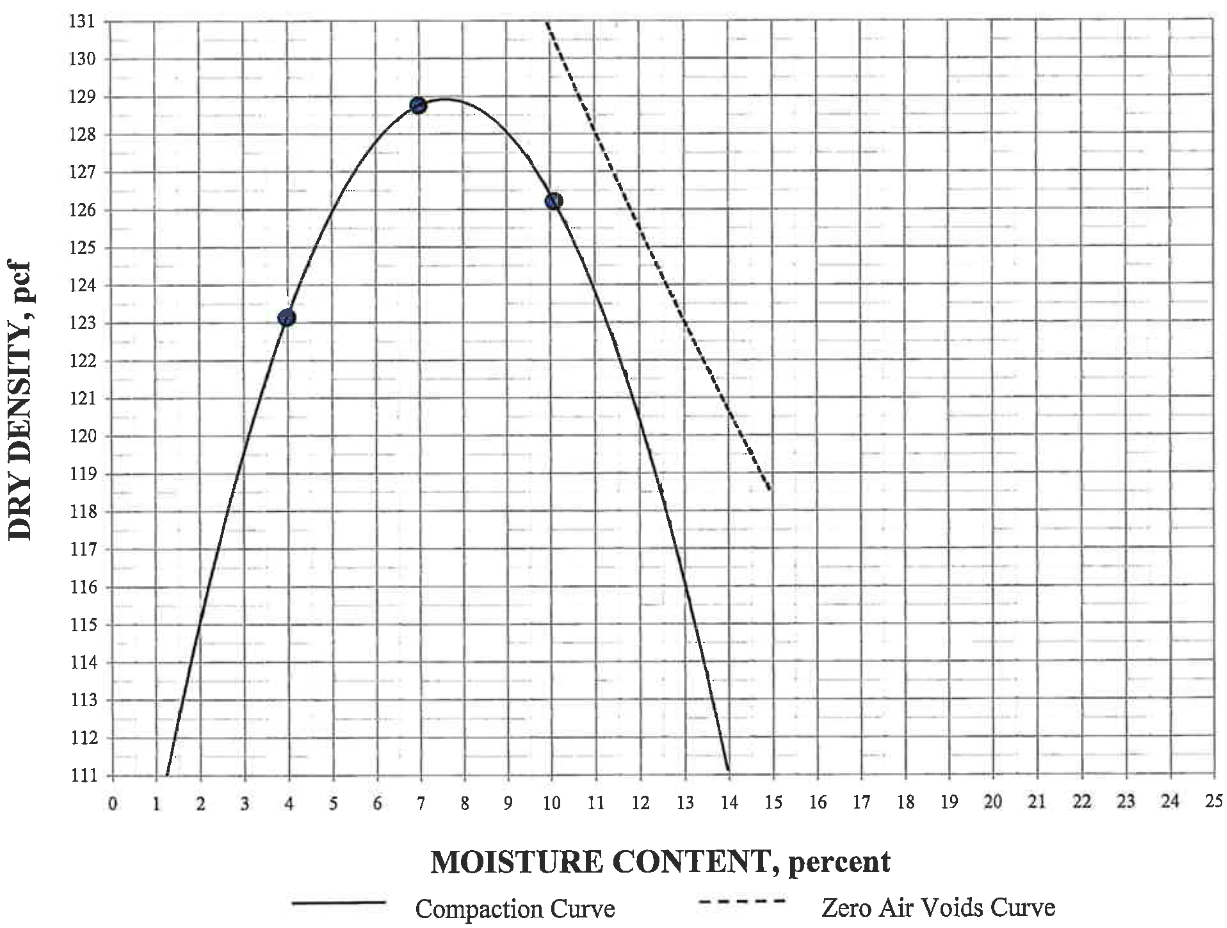
PROCEDURE USED: A
PREPARATION METHOD: Moist
RAMMER TYPE: Mechanical
SPECIFIC GRAVITY: 2.65 (assumed)

July 19, 2007
Boring #1 @ 6.0 - 10.0'
Silty Sand with Gravel (SM)

SIEVE DATA:

Sieve Size	% Retained
3/4"	0
3/8"	4
#4	15

MAXIMUM DRY DENSITY: 129.0 pcf
OPTIMUM MOISTURE: 7.5%



Cancer Center of Santa Barbara SL-14435-SB

DIRECT SHEAR

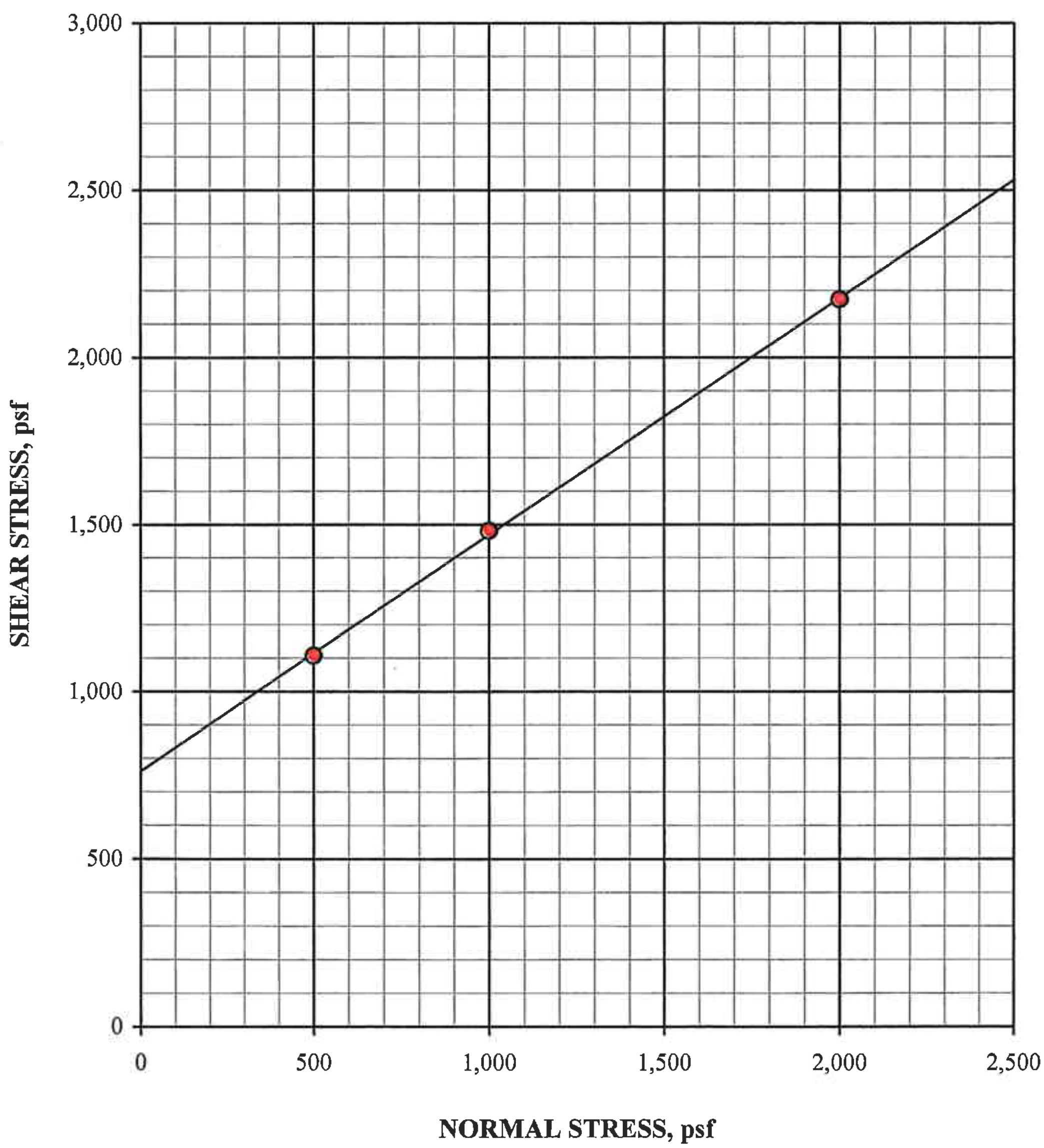
ASTM D 3080-04 (modified for consolidated, undrained conditions)

July 19, 2007

Boring #1 @ 6.0 - 10.0'
Silty Sand with Gravel (SM)
Compacted to 90% RC, saturated

INITIAL DRY DENSITY: 116.1 pcf
INITIAL MOISTURE CONTENT: 8.0 %
PEAK SHEAR ANGLE (Ø): 35°
COHESION (C): 762 psf

SHEAR vs. NORMAL STRESS



Cancer Center of Santa Barbara SL-14435-SB

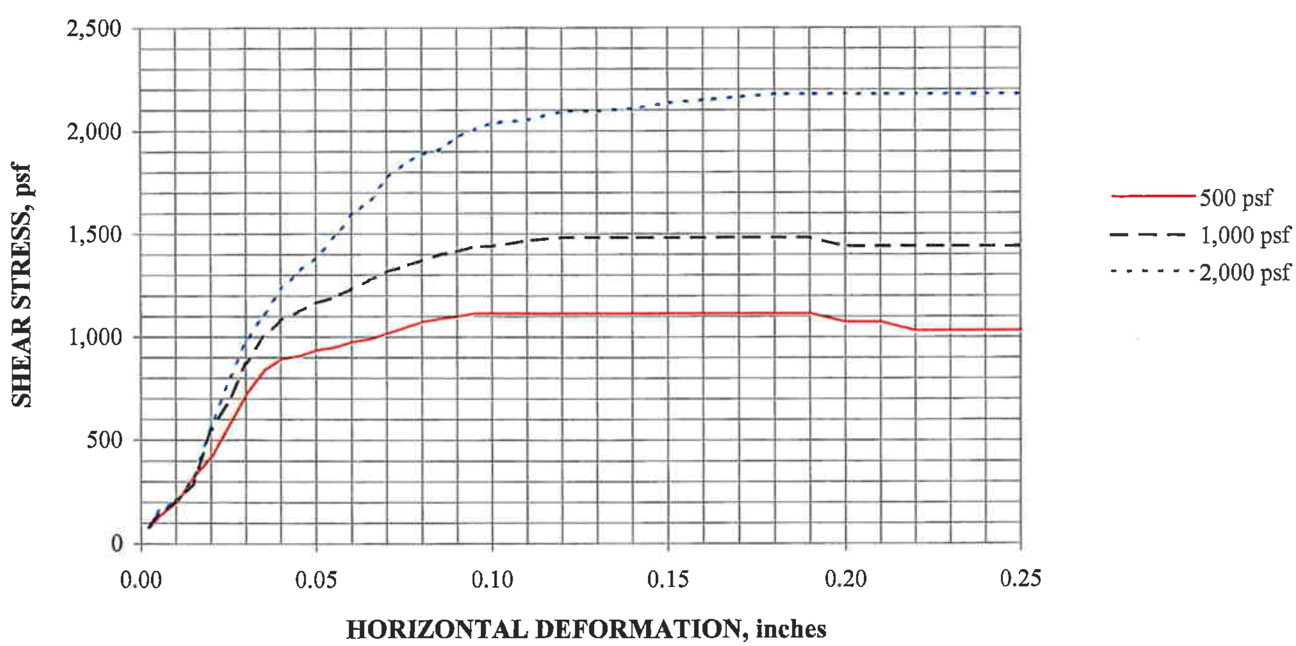
DIRECT SHEAR continued — **ASTM D 3080-04 (modified for consolidated, undrained conditions)**

Boring #1 @ 6.0 - 10.0' — July 19, 2007

Silty Sand with Gravel (SM)

Compacted to 90% RC, saturated — SPECIFIC GRAVITY: 2.65 (assumed)

SAMPLE NO.:	1	2	3	AVERAGE
INITIAL				
WATER CONTENT, %	8.0	8.0	8.0	8.0
DRY DENSITY, pcf	116.1	116.1	116.1	116.1
SATURATION, %	50.0	50.0	50.0	50.0
VOID RATIO	0.424	0.424	0.424	0.424
DIAMETER, inches	2.375	2.375	2.375	
HEIGHT, inches	1.00	1.00	1.00	
AT TEST				
WATER CONTENT, %	14.1	14.3	14.4	
DRY DENSITY, pcf	119.8	123.0	123.5	
SATURATION, %	98.5	100.0	100.0	
VOID RATIO	0.380	0.345	0.339	
HEIGHT, inches	0.97	0.94	0.94	



Cancer Center of Santa Barbara

SL-14435-SB

CONSOLIDATION TEST

ASTM D 2435-04

July 19, 2007

Boring #2 @ 5.0 - 5.5'
Silty Sand (SM)
Ring Sample

DRY DENSITY: 113.5 pcf
MOISTURE CONTENT: 7.8%
SPECIFIC GRAVITY: 2.65 (assumed)
INITIAL VOID RATIO: 0.458

VOID RATIO vs. NORMAL PRESSURE DIAGRAM

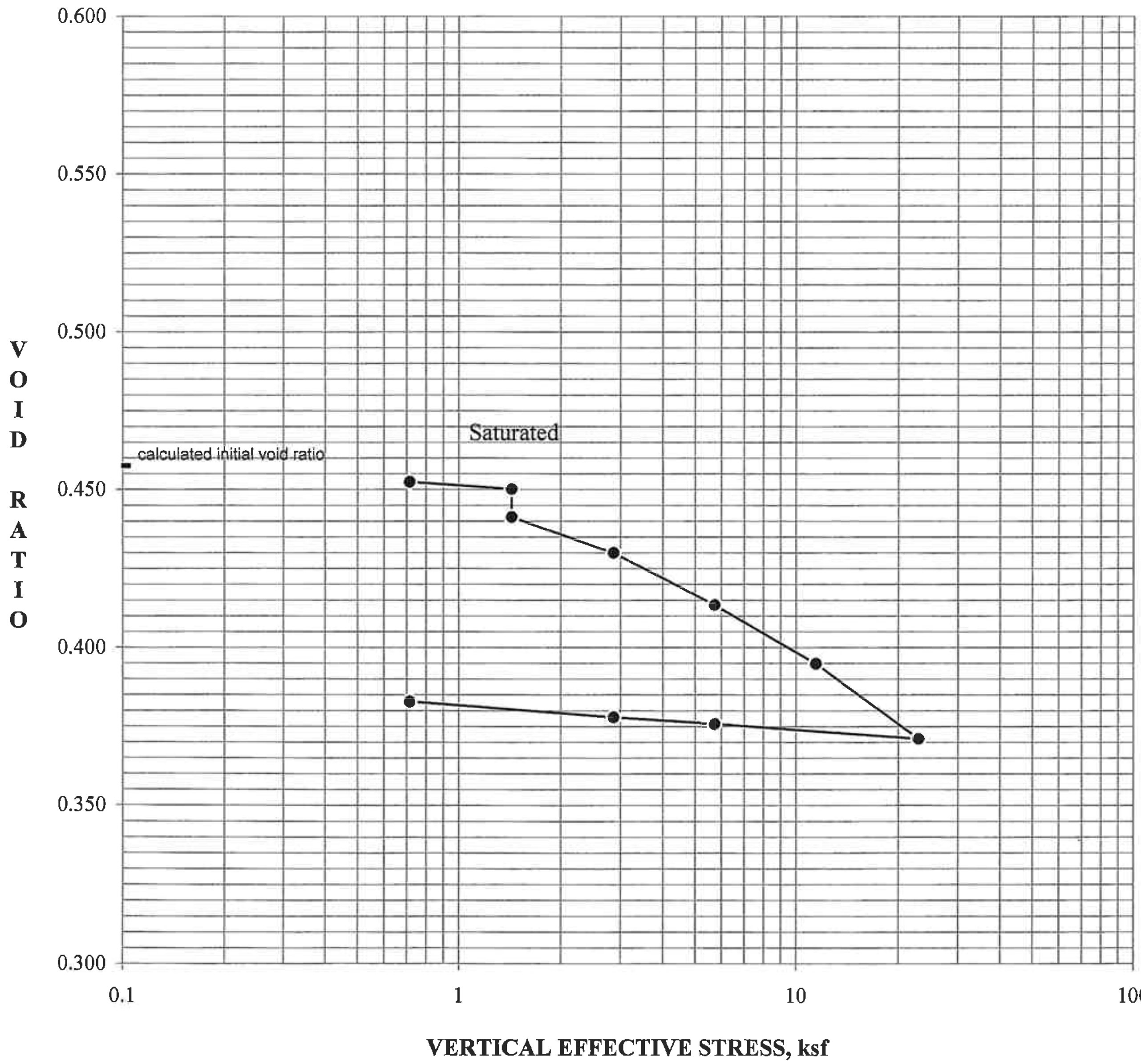


Table 1 - Laboratory Tests on Soil Samples

Earth Systems Pacific
Cancer Center of Santa Barbara
Your #SL-14435-SB, SA #07-0952LAB
6-Jul-07

Sample ID			B-1 @ 0-5' SM	B-1 @ 6-10' GW
Resistivity		**Units**		
as-received		ohm-cm	20,400	52,400
saturated		ohm-cm	3,200	4,000
pH			7.2	7.7
Electrical Conductivity		mS/cm	0.30	0.17
Chemical Analyses				
Cations				
calcium	Ca^{2+}	mg/kg	233	120
magnesium	Mg^{2+}	mg/kg	34	17
sodium	Na^{1+}	mg/kg	17	28
potassium	K^{1+}	mg/kg	34	10
Anions				
carbonate	CO_3^{2-}	mg/kg	ND	ND
bicarbonate	HCO_3^{1-}	mg/kg	308	314
flouride	F^{1-}	mg/kg	2.9	1.8
chloride	Cl^{1-}	mg/kg	16	7.1
sulfate	SO_4^{2-}	mg/kg	127	42
phosphate	PO_4^{3-}	mg/kg	31	2.9
Other Tests				
ammonium	NH_4^{1+}	mg/kg	6.9	0.5
nitrate	NO_3^{1-}	mg/kg	35.0	5.6
sulfide	S^{2-}	qual	na	na
Redox		mV	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.
Redox = oxidation-reduction potential in millivolts
ND = not detected
na = not analyzed

APPENDIX C

Geologic Map

Historical Earthquake/Fault Map

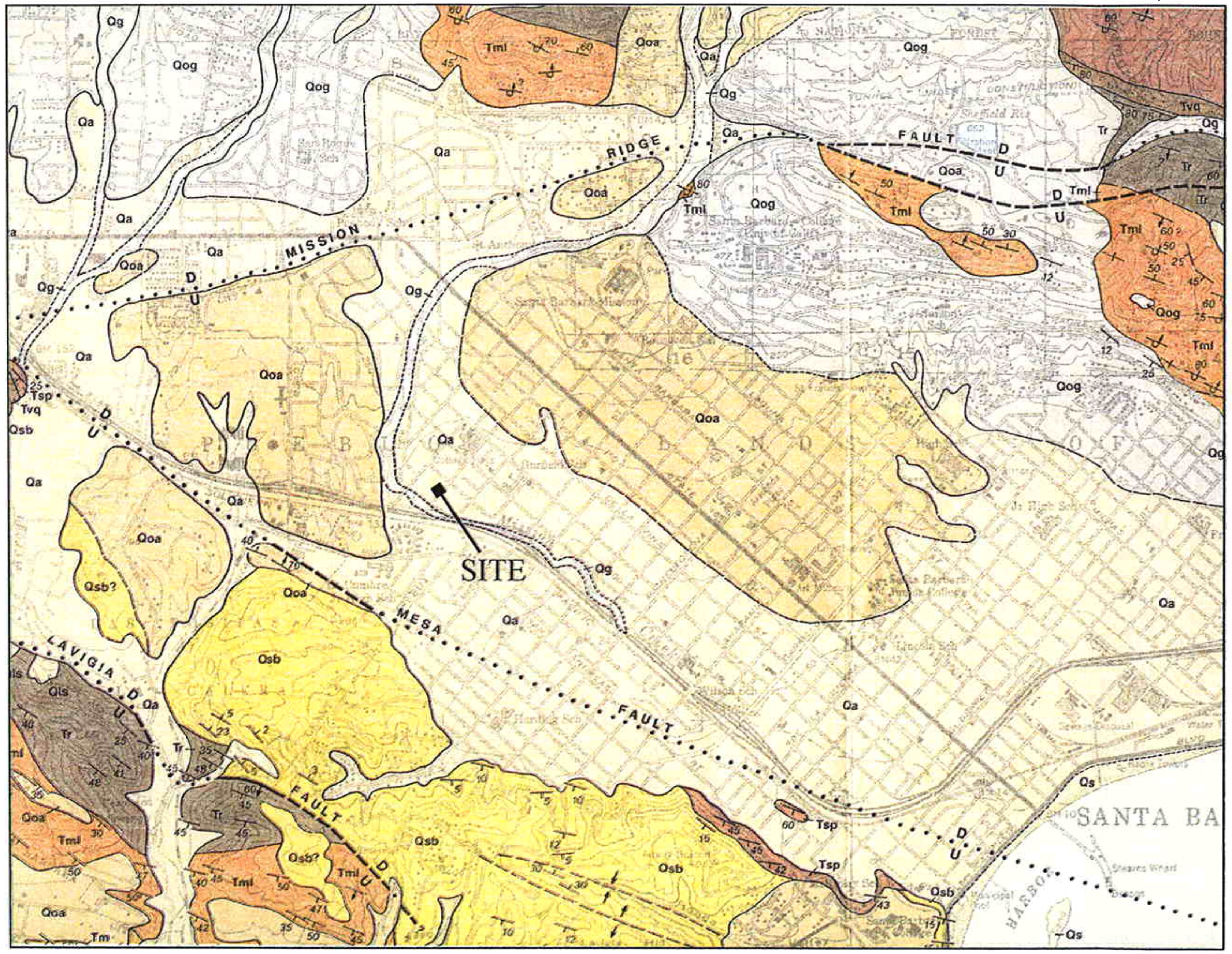
Design Response Spectra

GEOLOGIC MAP

CANCER CENTER OF SANTA BARBARA

540 West Pueblo Street

Santa Barbara, California



Extract from: Geologic Map of the Santa Barbara Quadrangle, T.W. Dibblee, Jr., 1986

EXPLANATION

Geologic Units

Surficial Sediments

Qs: beach sand deposits
Qg: stream channel deposits, mostly gravel and sand
Qa: alluvium; unconsolidated flood-plain deposits of silt, sand and gravel

Older Dissected Surficial Sediments

Qoa: former alluvial deposits of silt, sand and gravel

Qog: cobble – boulder fan gravel and fanglomerate deposits composed largely of sandstone detritus

Santa Barbara Formation

shallow marine; early Pleistocene and latest Pliocene (?)
Qsb: massive to bedded, poorly consolidated, tan to yellow fossiliferous sand and silt

Monterey Formation

marine; early to late Miocene age
Tm: upper shale unit
Tml: lower shale unit

Rincon Shale

marine; early Miocene age
Tr: poorly bedded gray clay shale or claystone

Vaqueros Sandstone

Tvq: massive to thick bedded sandstone

Sespe Formation

Tsp: silty shale or claystone with interbedded sandstone
Tspss: sandstone and claystone

Geologic Symbols

Contact
Dashed where approximately located or inferred

High-angle fault
Dashed where approximately located or inferred; dotted where concealed

Thrust or reverse fault
Dashed where approximately located or inferred; dotted where concealed. Saw-teeth on upper plate. Dip of fault plane between 30° and 80°

Anticline
Showing axis at surface. Dashed where approximately located; dotted where concealed

Syncline
Showing axis at surface. Dashed where approximately located; dotted where concealed

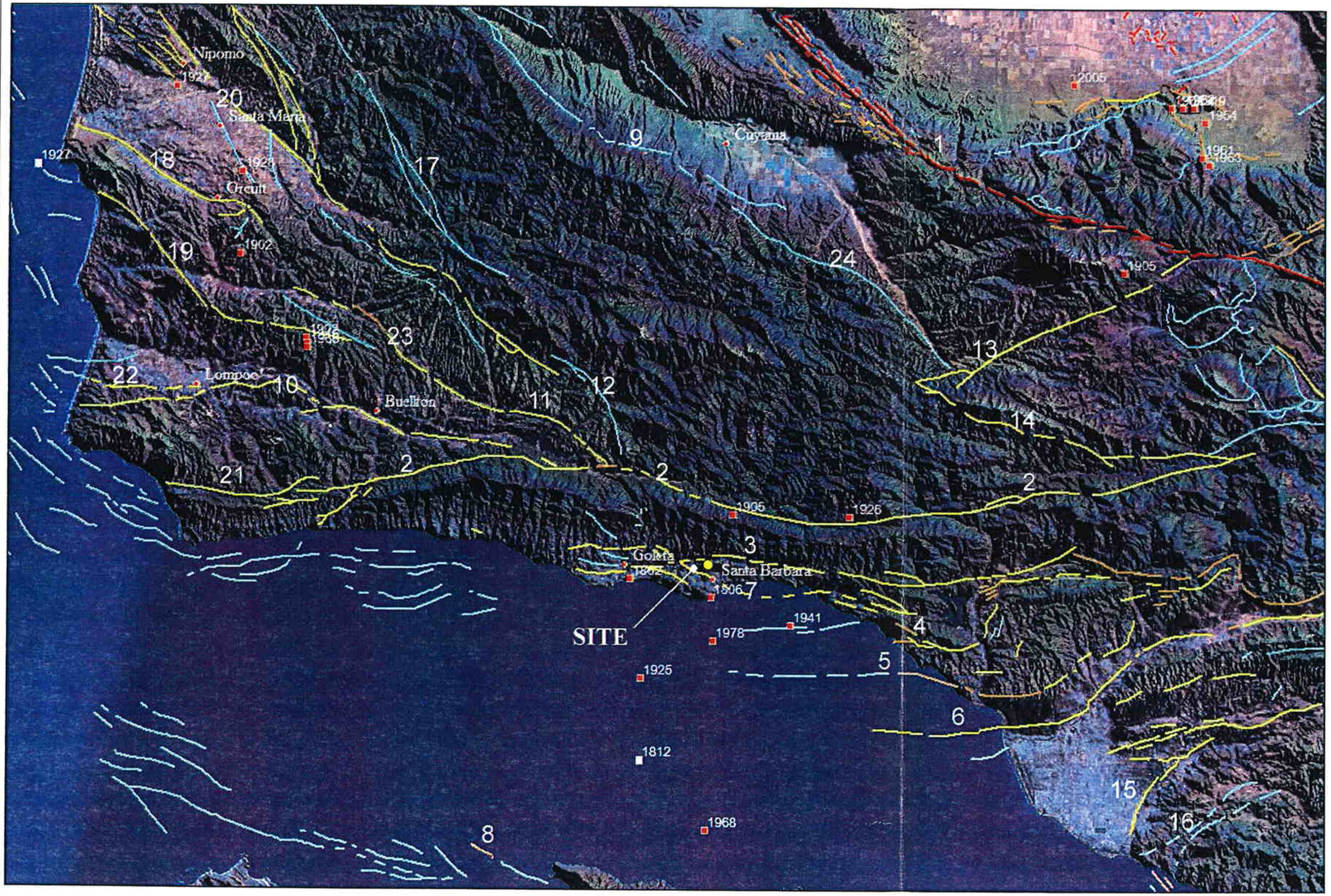
Horizontal — Inclined (30) — Vertical (90)
Strike and dip of beds

N

Approx. Scale: 1" = 2700'

Earth Systems Pacific
4378 Santa Fe Road, San Luis Obispo, CA 93401
July 2007
(805) 544-3276 - (805) 544-1786 Fax
www.earthsys.com - e-mail: esc@earthsystems.com

SL-14435-SB



HISTORICAL EARTHQUAKE/ FAULT MAP

CANCER CENTER OF SANTA BARBARA
540 Pueblo Street
Santa Barbara, California

LEGEND

Historic rupture (<200 years)
Holocene fault (<10,000 years)
Late Quaternary (<700,000 years)
Quaternary fault (<1.6 million)

Approximate Location of Site

HISTORICAL EARTHQUAKE MAGNITUDE

5.0 to 5.9 | 6.0 to 6.9 | 7.0 to 7.9

FAULTS

1 San Andreas	13 Big Pine
2 Santa Ynez	14 Pine Mountain
3 Mission Ridge-Arroyo Parida	15 Bailey
4 Red Mountain	16 Sycamore Canyon
5 Ventura-Pitas Point	17 East Huasna
6 Oak Ridge	18 Casmalia
7 Mesa-Rincon Creek	19 Lions Head
8 Santa Cruz	20 Santa Maria River
9 South Cuyama	21 Pacifico
10 Santa Ynez River	22 Honda
11 Baseline	23 Los Alamos
12 Little Pine	24 Ozena

Note: Not all faults are shown on map

REFERENCES

Blake, T.F., EQSEARCH, updated 2005
Jennings, C.W, 1994

N

(Approximate Scale: 1" = 10 miles)

Earth Systems Pacific
4378 Santa Fe Road, San Luis Obispo, CA 93401
July 2007

(805) 544-3276 - (805) 544-1786 Fax
www.earthsys.com - e-mail: esc@earthsystems.com
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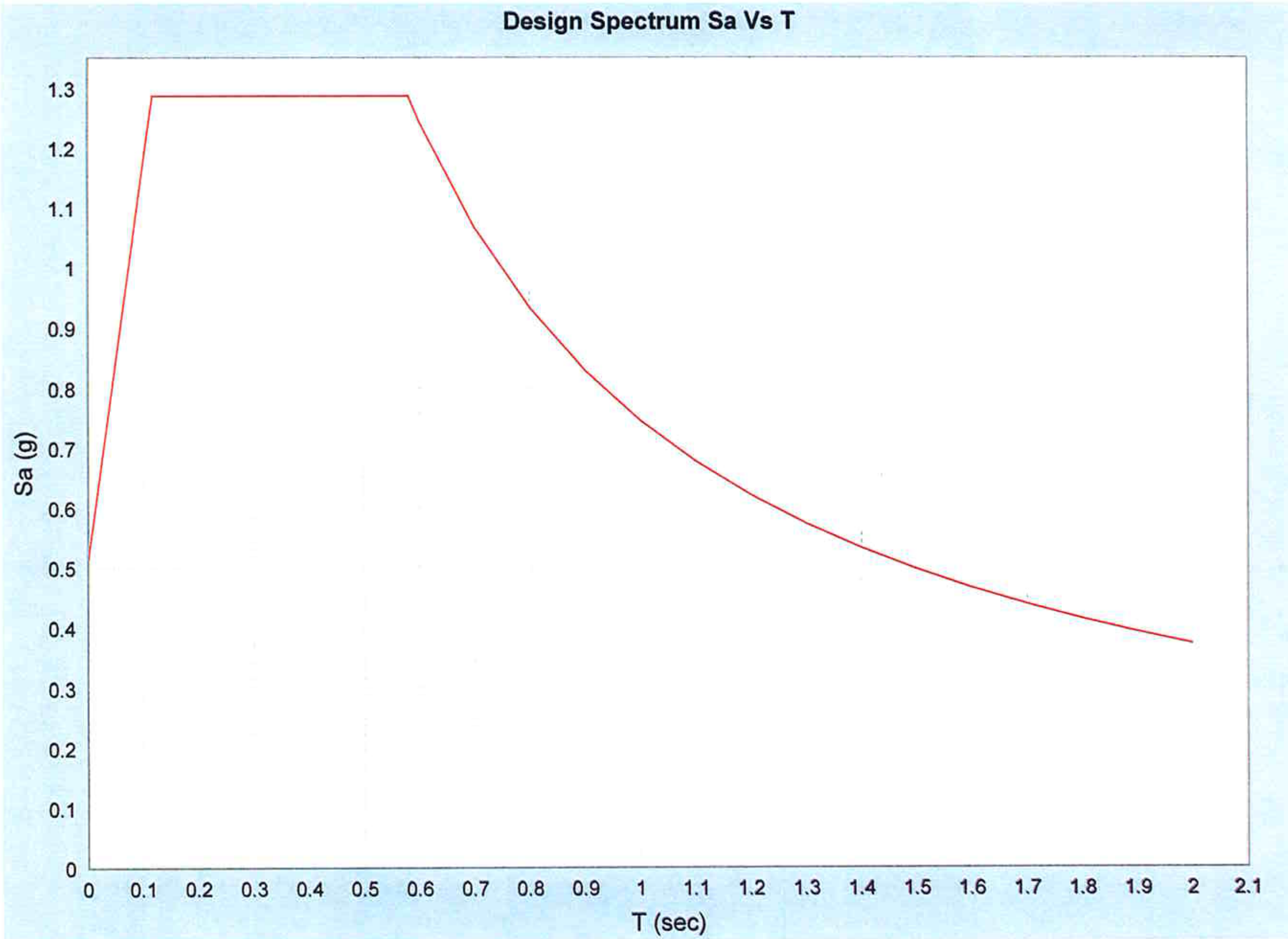

Design Spectrum Sa Vs T
Sa (g)
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2 2.1
T (sec)

APPENDIX D

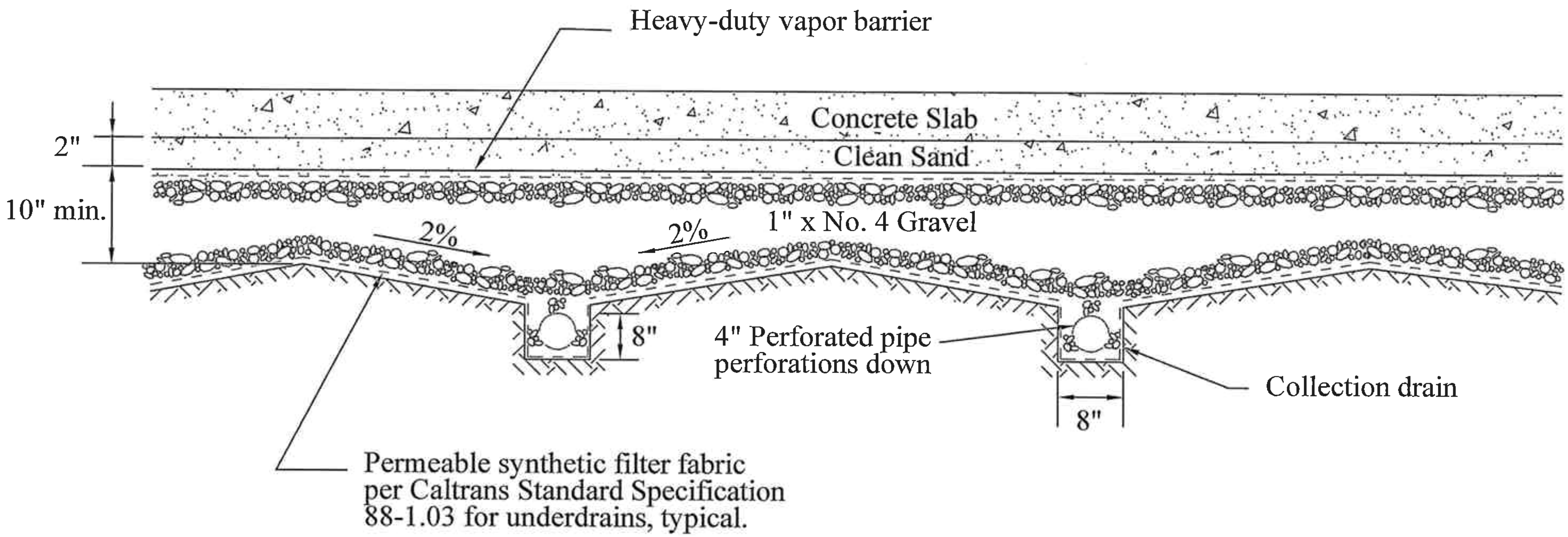
Subslab Blanket Drain Detail

Typical Detail A: Pipe Placed Parallel to Foundations

SUBSLAB BLANKET DRAIN

CANCER CENTER OF SANTA BARBARA

540 West Pueblo Street
Santa Barbara, California



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NOT TO SCALE

Earth Systems Pacific

2049 North Preisker Lane, Suite E
Santa Maria, California 93454
(805) 928-9221 • FAX (805) 928-9253
E-mail: esc@earthsys.com

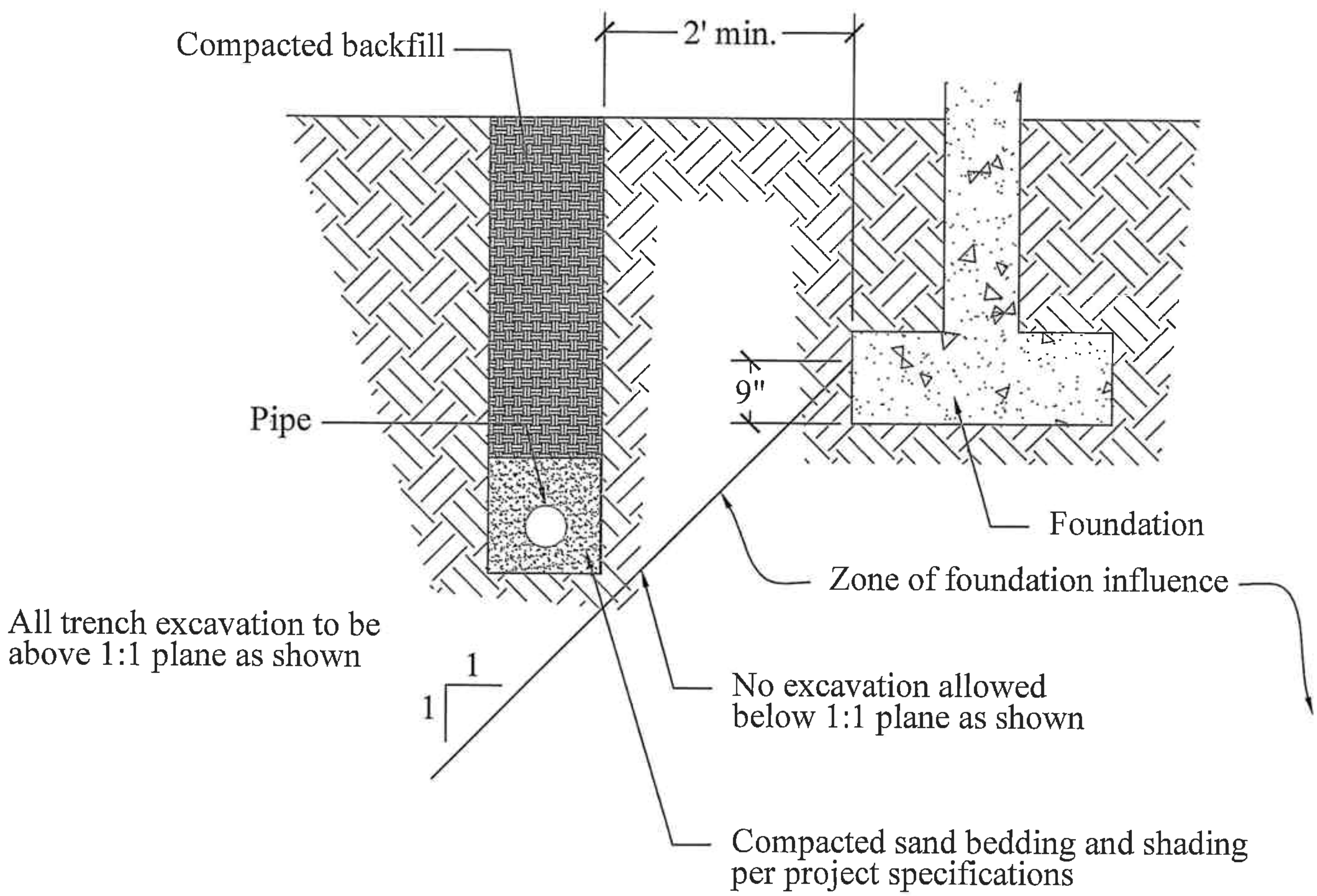
July 31, 2007

SMK

SL-14435-SB
DRAIN-D19-V02.dwg

TYPICAL DETAIL A:
PIPE PLACED PARALLEL TO FOUNDATIONS

CANCER CENTER OF SANTA BARBARA
540 West Pueblo Street
Santa Barbara, California



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